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FAB 17

MICROBIAL TOXINS IN FOODS

SELECTED FROM VOLUME 7 ISSUE 1-12

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H. BROOKES
ASSISTANT EDITOR

MICROBIAL TOXINS IN FOODS

VOLUME 7

FOOD ANNOTATED BIBLIOGRAPHY No. 17

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LANE END HOUSE,
SHINFIELD, READING RG2 9BB
ENGLAND.

ISBN 0 86014 129 2

First published in 1976

1

[Recent developments in the diagnosis of bacterial food intoxications.] Neuere Entwicklungen in der Diagnostik bakterieller Lebensmittelintoxikationen.
Untermann, F.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB 159 (3) 311-322 (1974) [36 ref. De, en] [Inst. für Lebensmittelhygiene, Fleischhygiene und -Tech., Fachrichtung Lebensmittelhygiene, Freie Univ., Berlin (West)]

Developments in methods for diagnosis of food intoxications caused by Clostridium botulinum, Cl. perfringens and staphylococci are reviewed, with reference to methods for detection of the toxins in foods (serological tests, haemagglutination tests, specific tests on animals) and methods for isolation and identification of toxigenic bacteria. The importance of food intoxications of bacterial origin is discussed with reference to data for the incidence of the various classes of food poisoning in the UK and the USA. AJDW

2

Enterotoxin production by strains of Staphylococcus aureus isolated from foods and human beings.
Wieneke, A. A.
Journal of Hygiene 73 (2) 255-262 (1974) [13 ref. En] [Central Public Health Lab., Colindale Avenue, London NW9 5HT, UK]

21-26% of 112 strains of Staph. aureus isolated from raw meat, sausages and poultry, and 32-36% of 183 strains isolated from cooked foods, e.g. meat, chicken and frozen seafoods, produced enterotoxins A, B, C, D or E. The Staph. aureus isolated from raw meat and chicken less frequently produced enterotoxins A, B, C or E and more frequently enterotoxin D, than those from cooked meat and seafoods. Of the 113 strains isolated from cheese and raw milk, 6-11% produced enterotoxin and most of these produced enterotoxin D. Only a few strains isolated from foods produced enterotoxin E. Results of enterotoxin tests on Staph. aureus from humans resembled those on strains from cooked foods. AS

3

Lipolytic activity of staphylococci, isolated from milk products.
Lukasova, J.; Vavrova, M.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, II 129 (4/4) 278-285 (1974) [13 ref. En, de] [Dept. of Food Hygiene & Tech., Univ. of Vet. Med., Brno, Czechoslovakia]

A total of 194 strains of Staphylococcus aureus were isolated from raw, pasteurized and dried milk, sweetened condensed milk, ice cream, processed cheese and sweetened curd cream; approx. half of the isolates from each product were lipolytic. The 126 coagulase-positive and 68 coagulase-negative strains of Staph. aureus failed to show any relationship between coagulase production and lipolytic activity towards Tween 20, Tween 60, Tween 80 or butterfat. Analysis of milk fat from cream and whipped cream showed an increase in contents of total and individual free fatty acids, particularly palmitic and myristic acids, as a result of the action of Staph. aureus 155 from pasteurized milk. CDP

4

Effect of butterfat on inhibition of Staphylococcus aureus by nisin.
Jones, L. W.
Canadian Journal of Microbiology 20 (9) 1257-1260 (1974) [10 ref. En, fr] [Dept. of Biology, Utah St. Univ., Logan, Utah 84322, USA]

5

Effect of potassium sorbate on salmonellae, Staphylococcus aureus, Clostridium perfringens, and Clostridium botulinum in cooked, uncured sausage.
Tompkin, R. B.; Christiansen, L. N.; Shaparis, A. B.; Bolin, H.
Applied Microbiology 28 (2) 262-264 (1974) [8 ref. En] [Swift & Co., Res. and Development Center, Oak Brook, Illinois 60521, USA]

Skinless precooked, uncured sausage links with and without potassium sorbate (0.1% w/w) were inoculated with salmonellae, Staphylococcus aureus, Clostridium perfringens and Clostridium botulinum and held at 27°C to represent temp. abuse of the product. Total counts of uninoculated product showed that the normal spoilage flora was delayed 1 day when sorbate was present. Growth of salmonellae was markedly retarded by sorbate. Growth of Staph. aureus was delayed 1 day in the presence of sorbate, after which growth occurred to the same level as in product without sorbate. Cl. perfringens declined to below detectable levels within the 1st day in product with and without sorbate. Sorbate retarded the growth of Cl. botulinum. Botulinal toxin was detected in 4 days in the product without sorbate but not until after 10 days in the product with sorbate. AS

6

Prevention of foodborne illness by time-temperature control of thawing, cooking, chilling, and reheating turkeys in school lunch kitchens.
Bryan, F. L.; McKinley, T. W.
Journal of Milk and Food Technology 37 (8) 420-429 (1974) [37 ref. En] [Center for Disease Control, Public Health Service, Dept. of Health, Education & Welfare, Atlanta, Georgia 30333, USA]

Turkey served in schools is often incriminated as a vehicle of foodborne illness. Practices that could contribute to outbreaks were studied in 3 schools. Clostridium perfringens, Staphylococcus aureus, and Salmonella were isolated from raw carcasses, and Cl. perfringens from cooked meat and surfaces of equipment. 20-lb carcasses thawed in a refrigerator or in paper bags at room temp. showed no significant opportunities for multiplication of bacteria; carcasses thawed at room temp. without bags could, however, support multiplication of psychrotrophic bacteria. The several days required for refrigerator-thawing is longer than can be provided in schedules. All baking methods were satisfactory. Turkey rolls took more time to reach internal temp. of 165°F than is practicable for service operations. <30 min was saved by baking half instead of whole turkeys. Refrigerated whole turkeys and pots of stock cooled slowly. Immersing double-plastics-bagged meat and halved rolls in an ice bath and slicing meat onto ice-cold pans speeded cooling. Stock was chilled rapidly when half-filled 5-gal pots were set in either an ice or a running-water bath. Chilled meat was reheated to 165°F in steamers, in kettles of boiling gravy, in lid-covered pans on a range, and in ovens. Ovens were slowest to bring meat to the required temp. often too slow to be practicable. 20 ways to reduce risk inherent in thawing, cooking, chilling, and reheating practices are described. AS

7

Loss of viability and metabolic injury of Staphylococcus aureus resulting from storage at 5°C.
Jackson, H.
Journal of Applied Bacteriology 37 (1) 59-64 (1974) [15 ref. En] [Food Res. Inst., Colney Lane, Norwich, NOR 70F, Norfolk, UK]

8

Microbiological quality of pedha.
Kamat, M. Y.; Sulebele, G. A.
Journal of Food Science and Technology, India 11 (2) 50-53 (1974) [39 ref. En] [Dept. of Chem. Tech., Univ. of Bombay, India]

Samples of pedha, a type of Indian sweet, purchased from the local market were examined for their total microbial profile in terms of psychrophilic, mesophilic, thermophilic counts, coliforms and for the presence of coagulase-positive staphylococci. The mesophilic count was the highest followed by psychrophilic and thermophilic counts. Coliforms, surprisingly, could not be detected in any of the samples examined. Staphylococci were detected in 14 of the 16 samples of which 4 were coagulase-positive and 64.3% of the strains isolated haemolysed human red blood cells. Other characteristics of the staphylococcal strains such as horse and rabbit blood haemolysis, gelatin liquefaction, aerobic and anaerobic mannitol fermentation and chromogenesis were studied. The need to establish microbiological quality standards to protect the consumer has been stressed. AS

9

[Biochemical properties of strains of staphylococci isolated from cows' milk.]
Damm, A.
Medycyna Weterynaryjna 30 (8) 474-475 (1974) [15 ref. Pl] [Zaklad Higieny Weterynaryjnej, Krakow, Poland]

10

[Fermented fish products and botulism.] [Review]
Hauge, S.
Norsk Veterinaertidsskrift 86 (7/8) 350-353 (1974) [31 ref. No, en] [Norges Veterinaerhogskole, Inst. for Naeringsmiddelhygiene, Norway]

After a brief description of various fermented fish products (the Norwegion 'rakefisk' and 'boknafisk' and the Japanese 'izushi', 'biribosni' and 'kombaki') with special reference to their implication in outbreaks of botutism, the manufacture of rakefisk is discussed on the basis of literature data. Aspects considered include quantities of salt required, maturation and storage temp., and the relative importance of microbial and autolytic fermentation. It is suggested that maturation and storage at temp. ≤2°C is desirable, to prevent growth and toxin production by Clostridium botulinum. AJDW

11

Minimum nitrite concentrations for inhibition of clostridia in cooked meat products. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Grever, A. B. G. (Netherlands, Central Institute for Nutrition & Food Research TNO)
pp. 103-109 ISBN 90-220-0463-5 (1974) [11 ref. En] Wageningen, Netherlands [Central Inst. for Nutr. and Food Res. TNO, Utrechtseweg 48, Zeist, Netherlands]

Laboratory- and factory-prepared cooked sausage and liver sausage emulsions (brine percentage 3.5, nitrite concn. 0-200 mg/kg) were packaged in 76 × 35 mm cans (with or without inoculation with clostridia or various spore-bearing materials) and pasteurized to a core temp. of 80°C for 10 min. The pasteurized cans were then stored for 1, 3 or 5 wk at 24°C, after which they were tested for residual nitrite content and growth of spore-forming bacteria. Similar studies were conducted on luncheon meat and liver paste emulsions (containing 100 or 200 mg nitrite/kg) inoculated with spore counts of 100 or 500/g, canned, and heated at 95 or 105°C with F_o values of 0.05 or 0.5 respectively. Growth of spore-forming bacteria was evaluated after incubation for 5 wk at 30°C. Detailed tables and diagrams of results are given. The studies on pasteurized emulsions showed that a nitrite concn. of 200 mg/kg and pH ≤6.2 is necessary to guarantee

complete prevention of growth of clostridia. The studies on sterilized samples showed incomplete inhibition of clostridia in samples heated to an F_o value of 0.05, even in the presence of 200 mg/kg nitrite. No growth of clostridia occurred in samples heated to a F_o value of 0.5. Bacilli were less nitrite-sensitive than clostridia. AJDW

12

Inhibition of bacterial growth in model systems in relation to the stability and safety of cured meats. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Roberts, T. A. (Netherlands, Central Institute for Nutrition & Food Research TNO)
pp. 91-101 ISBN 90-220-0463-5 (1974) [9 ref. En] Wageningen, Netherlands [ARC Meat Res. Inst., Langford, Bristol, BS18 7DY, UK]

The interaction of factors (pH, temp., nitrates, nitrites, NaCl) influencing bacterial growth is discussed on the basis of literature data, with special reference to inhibition of Clostridium botulinum by nitrite. Methods for evaluation of inhibitory activity of curing salts are briefly discussed, with reference to effects of media, selection of strains of bacteria to be tested, and use of growth-no growth tests, viable counts by the MPN method, and counts of viable bacteria in agar media. AJDW

13

The microbiological effects of nitrite. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Ingram, M. (Netherlands, Central Institute for Nutrition & Food Research TNO)
pp. 63-74 ISBN 90-220-0463-5 (1974) [42 ref. En] Wageningen, Netherlands [ARC Meat Res. Inst., Langford, Bristol, BS18 7DY, UK]

The inhibition of microorganisms by nitrite is discussed on the basis of literature data, with special reference to its significance for the curing of meat products. Aspects covered include: chemical and biochemical properties of nitrite; antibacterial effects in heated and unheated systems; effects of temp., NaCl, pH, nitrate and degree of initial microbiological contamination on the antibacterial activity of nitrite; possible mechanisms for the inhibitory activity of nitrite; studies on formation of inhibitory substances from nitrite in culture media and in meat; inoculated pack experiments; and the importance of nitrite for control of Clostridium botulinum in cured meat products. AJDW

14

Inhibitors in cooked meat products. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Roon, P. S. van (Netherlands, Central Institute for Nutrition & Food Research TNO)
pp. 117-124 ISBN 90-220-0463-5 (1974) [16 ref. En] Wageningen, Netherlands [Inst. of Food Hygiene, Dept. of Meat Tech., Fac. of Vet. Sci., Univ. of Utrecht, Biltstraat 172, Netherlands]

The possible formation of inhibitory iron-nitrosyl coordination complexes in canned cured meat products is discussed, with reference to studies on inhibition of clostridia by Black Roussin salt (BRS) and cysteyl-nitrosyl complexes formed by reaction of cysteine and $FeSO_4$ with $NaNO_2$ or NO. The results showed that both BRS and the cysteyl-nitrosyl-Fe coordination complex inhibited growth of clostridia. A tentative method (based on extraction with methanol, purification on an Al_2O_3 column and determination by spectrophotometry at 350 nm) was developed; recovery from luncheon meat containing added BRS was 47%. No BRS was detected in samples of normal luncheon meat or luncheon meat containing added $FeSO_4$ and/or cysteine. Possible reasons for its absence are discussed. The likelihood of formation of cysteine-nitrosyl-Fe coordination complexes in canned cured meat products is briefly discussed, with reference to the absence of a detectable Perigo effect in heated cured meat products. AJDW

15

The inhibition of Clostridium botulinum by nitrite and sodium chloride. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Baird-Parker, A. C.; Baillie, M. A. H. (Netherlands, Central Institute for Nutrition & Food Research TNO)
pp. 77-90 ISBN 90-220-0463-5 (1974) [14 ref. En] Wageningen, Netherlands [Unilever Res. Lab., Colworth/Welwyn, Colworth House, Sharnbrook, Bedford, UK]

Studies on inhibition of a wide range of toxigenic types of Clostridium botulinum by $NaNO_2$ and/or NaCl are discussed. Factors studies included $NaNO_2$ concn. (50, 100, 150 or 200 ppm); pH (5.5, 6.0, 6.5, 7.0); NaCl concn. (1.5, 3.0, 4.5, 6.0% w/v); incubation temp. (15, 20, 25 or 30°C); incubation time (≤28 days, or ≤56 days for samples incubated at 15°C); and medium (modified reinforced clostridial medium or Pork Macerate Broth). Tables of values are given showing the extent of growth of C. botulinum in the various samples. The results are discussed in detail. It was observed that: strains differed markedly in their resistance to NaCl and $NaNO_2$; type A and proteolytic type B and F strains being more resistant than type E and non-proteolytic type B and F strains; inhibitory activity decreased with

increasing incubation temp.; NaCl and $NaNO_2$ exhibit a synergistic inhibitory activity; L-ascorbic acid increased the inhibitory activity or nitrite in Modified Reinforced Vlostridial Medium, but not in Pork Macerate Broth. Preliminary experiments on laboratory-cured bacon, vacuum-packaged and stored at 25°C showed that nitrite-free bacon supported growth and toxin production by C. botulinum; 100-200 mg nitrite/kg bacon effectively inhibited C. botulinum. Addition of 0.1% ascorbic acid had no effect on the inhibitory activity of nitrite in bacon. AJDW

16

Perigo effect in pork. In "Proceedings of the International Symposium on Nitrite in Meat Products". [Conference proceedings]
Pivnick, H.; Chang, P.-C. (Netherlands, Central Institute for Nutrition & Food Research TNO) pp. 111-116 ISBN 90-220-0463-5 (1974) [13 ref. En] Wageningen, Netherlands [Food Res. Lab., Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Canada]

An inhibitor against Clostridium botulinum was formed when canned pork luncheon meat was processed to $F_o = 0.4$. The meat was manufactured with 0-300 mg/kg of $NaNO_2$ and all of it was held at 35°C after processing until the highest concn. of nitrite declined to less than 2 mg/kg. Meat in cans was then inoculated with spores of Cl. botulinum that had survived a heat treatment of $F_o = 0.4$ in a solution of raw meat juice, 4.5% salt and 150 mg/kg of $NaNO_2$. The inhibitory effect could be demonstrated by an increase in time required for inoculated cans to swell and by the number of spores required to initiate growth and cause swelling. However, the inhibitory effect was relatively small; meat made with 3.8% salt in the water phase and 200 mg/kg of nitrite inhibited 3.3 log_{10} of spores (3.3 units of inhibition). Salt contributed 1.86 units and the inhibitor formed from nitrite contributed 1.43 units. AS

17

[Bacteriological control of canned foods.]
Cheftel, H.
Annales des Falsifications et de l'Expertise Chimique **67** (719/720) 443-450 (1974) [7 ref. Fr]

After a general discussion on the bacteriological stability of heat-treated ranned foods, the article continues with a description of the methods used to assess the bacteriological quality of canned foods. The author suggests that random samples of at least 12 cans should be taken. 2 of them are opened aseptically and one portion of the contents stored in a refrigerator, while the remainder is used to measure the pH, colour and odour and for microscopic examinations. 10 samples are similarly examined after incubation at 32°C for 15 days. If the incubated sample does not differ markedly from the non-incubated sample, the product is considered satisfactory, but if one of the incubated samples is contaminated, then the whole batch should be rejected. Incubation at 55°C to indicate the presence of thermophiles, and methods for detecting toxins in canned foods are also discussed briefly. MEG

18

The incidence of enterotoxin production in strains of Staphylococcus aureus isolated from foods.
Payne, D. N.; Wood, J. M.
Journal of Applied Bacteriology **37** (3) 319-325 (1974) [13 ref. En] [British Food Manufacturing Ind. Res. Assoc., Randalls Road, Leatherhead, Surrey, UK]

134 strains of Staph. aureus from meat products, 48 from dairy products and 18 miscellaneous strains were tested by a double diffusion immunoprecipita- tion technique for production of enterotoxins A, B, C, D and E. A total of 125 strains produced ≥1 enterotoxin, the most frequent type being A, which was produced alone by 59 strains and in conjunction with D by 15, with E by 6 and with C + D by 6; 8 strains produced enterotoxin C only, and 11 produced E only. The descending order for frequency of enterotoxins produced by ≥4 strains was: strains from meat products, A>AD>C>D; and strains from dairy products, A>D>CD and ACD. Enterotoxin production showed a closer correlation with rabbit plasma coagulation than with porcine plasma coagulation, and did not appear to be related to bacteriophage type. CDP

19

The survival and growth of Bacillus cereus in boiled and fried rice in relation to outbreaks of food poisoning.
Gilbert, R. J.; Stringer, M. F.; Peace, T. C.
Journal of Hygiene **73** (3) 433-444 (1974) [21 ref. En] [Central Public Health Lab., Golindale Avenue, London NW9 5HT, UK]

A number of outbreaks of food poisoning attributed to Bacillus cereus have been reported recently and all have been associated with cooked rice usually from Chinese restaurants and 'take-away' shops. Tests were made to assess the heat resistance of B. cereus spores in aqueous suspension, the growth of the organism in boiled rice stored at temp. in the range 4-55°C, and the effect of cooking and storage on the growth of the organism in boiled and fried rice. The spores of B. cereus survived cooking and were capable of germination and outgrowth. The optimum temp. for growth in boiled rice was between 30° and 37°C and growth also occurred during storage at 15° and 43°C. To prevent further outbreaks it is suggested that rice should be boiled in smaller quantities on several occasions during the day, thereby reducing the storage time before frying. After boiling the rice should either be kept hot (>63°C) or cooled

quickly and transferred to a refrigerator within 2 h of cooking. Boiled or fried rice must not be stored under warm conditions especially in the range 15-50°C. AS

20

Current trends in botulism in the United States.
Merson, M. H.; Hughes, J. M.; Dowell, V. R.; Taylor, A.; Barker, W. H.; Gangarosa, E. J.
Journal of the American Medical Association *229 (10) 1305-1308 (1974) [41 ref. En] [Bacterial Diseases Div., Bureau of Epidemiology, Center for Disease Control, Atlanta, Georgia 30333, USA]*

Outbreaks of botulism reported to the Center for Disease Control in the 4 yr 1970-1973 are reviewed. Thirty outbreaks involved 91 cases, with 21 deaths; the incidence of type A, B, and E toxins is given. Of the 30 outbreaks, 13 were caused by vegetables, 6 by fish, 4 by other sources (canned meat balls, soup, antipasta, blackberries) and 7 undetermined. The outbreaks from vegetable products were attributed to peppers in 7 of the 13 cases. Samples of mushrooms were also found to be contaminated, but with no recorded cases. Improvements in detection of toxin in faeces and by electromyography are recorded. The value of antitoxin therapy is uncertain (except for type E), with 21% side reactions. The most urgent need is education of the home canner and strict observance of legal requirements by industrial canners of low-acid foods. ELC

21

[Production of an antienterotoxic serum, type A, for diagnosing staphylococcal food poisoning.]
Bugrova, V. I.; Nikolaeva, I. S.
Voprosy Pitaniya No. 6, 47-51 (1974) [15 ref. Ru, en] [Inst. Pitaniya AMN SSR, Moscow, USSR]

22

[The epidemiology of human botulism. Investigation and aetiological hypothesis: possible role of cheese and straw.]
Gilles, G.; Jouglard, J.; Sebald, M.
Bulletin de l'Academie Veterinaire de France 47 (3) 165-174 (1974) [12 ref. Fr] [Lab. des Services Vet., Marseille, France]

Cases of botulism involving 32 persons in 19 lower class Marseille families and 43 upper class persons throughout Switzerland were shown, from a study of consumption of 60 foods commonly connected with this form of food poisoning to be most likely due to Brie cheese. Although no bacteriological evidence was found, various reasons are presented to support a hypothesis that the outbreaks were due to consumption of portions cut from 2-kg Brie cheeses which had been displayed for sale on contaminated straw. A discussion of the paper is included on pp. 172-174. CDP

23

Detection of preformed enterotoxins of staphylococci in dairy products employing serological method.
Ghosh, S. S.; Laxminarayana, H.
Indian Journal of Experimental Biology 11 (5) 457 (1973) [8 ref. En] [Nat. Dairy Res. Inst., Karnal, India]

Out of 76 samples of milk and milk products [tested by the micro-slide gel diffusion technique], only 6 (8%) showed detectable levels of enteroxin A or B (3 of 48 milk samples, 2 of 20 Cheddar cheese samples, and 1 of 8 dried skim-milk samples). It is suggested that, although the number of samples containing detectable levels of enterotoxin is small, the presence of even a few such samples is sufficient to cause outbreaks of food-poisoning. AS

24

Enterotoxigenicity of antibiotic-resistant Staphylococcus aureus cultures isolated from mastitis milk. [Conference proceedings]
Zaadhof, K. J.; Terplan, G.
XIX International Dairy Congress 1E, 133 [2 ref. En] [Vet. Fac., Univ. of Munich, Federal Republic of Germany]

23 of 65 antibiotic-resistant staphylococci but only 15 of 137 antibiotic-sensitive strains produced enterotoxin (predominantly type D); an association between antibiogram and type of enterotoxin could not be derived. CDP

25

[F-effect of sterilization conditions for canned fish in tomato sauce.]
Valyavskaya, M. E.; Troigo, T. V.; Kaushanskaya, L. Z.
Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya No. 2, 82-85 (1974) [6 ref. Ru] [Odesskii Tekh. Inst. Pishchevoi Promyshlennosti im. M. V. Lomonosova, USSR]

Details are given of studies conducted to determine the thermal resistance constants D and Z for Clostridium sporogenes spores in extracts of canned fish in tomato sauce, and to establish the sterilization effect (F-value). The products investigated differed in fat content (5.6-9.3%) and pH (5.20-5.91). It was found that the thermal resistance of the spores differed significantly in different products; F-values for sterilization of all the products studied are given. STI

26

The Perigo effect in luncheon meat.
Chang, P.-C.; Akhtar, S. M
Canadian Institute of Food Science and Technology Journal 7 (2) 117-119 (1974) [7 ref. En, fr] [Div. of Microbiol., Food Res. Lab., Health Protection Branch, Health & Welfare Canada, Ottawa, Ontario K1A OL2, Canada]

Growth of Clostridium botulinum from spores was inhibited in homogenates of luncheon meat produced commercially with varying amounts of sodium nitrite. The inhibition increased with increasing concn. of nitrite present before the heating process but could not be accounted for by residual nitrite. It is concluded that a Perigo type inhibitor is formed during commercial processing of a luncheon meat. AS

27

Effect of sodium nitrite on Clostridium botulinum in canned luncheon meat: evidence for a Perigo-type factor in the absence of nitrite.
Chang, P.-C.; Akhtar, S. M.; Burke, T.; Pivnick, H.
Canadian Institute of Food Science and Technology Journal 7 (3) 209-212 (1974) [23 ref. En, fr] [Microbiol. Div., Res. Lab., Food Directorate, Health Protection Branch, Health & Welfare Canada, Ottawa, Ontario, Canada]

Canned shelf-stable luncheon meat containing varying amounts of sodium nitrite, prepared according to a commercial formula, was processed at 110°C to Fo = 0.4 and held at 35°C until nitrite was no longer detectable. The meat was then inoculated with spores of Clostridium botulinum separately heated to Fo = 0.4 and the cans were incubated at 30°C. Swelling of cans with concomitant toxin production was related directly to the size of the inoculum and inversely to the concn. of nitrite at time of manufacture. Meat containing 200 ppm nitrite at time of manufacture (<2 ppm when inoculated) inhibited 1.43 $\log_{10}$ more spores than meat that was manufactured without nitrite. It appears that an inhibitor, which we call Perigo-type Factor, is formed during commercial processing of shelf-stable luncheon meat that contains nitrite. AS

28

Evaluation of methods to determine Bacillus cereus.
Fonden, R.
XIX International Dairy Congress 1E, 550 (1974) [3 ref. En] [Mjolkcentralen, Stockholm, Sweden]

The number of B. cereus in dairy products may be determined by plating on a blood agar medium; colonies suspected of being B. cereus are then spread on the medium of Kim & Goepfert [Applied Microbiology (1971) 22, 581], and isolates are confirmed as B. cereus by morphological characteristics, and mannitol and egg-yolk reactions. MJL

29

Cold shock lethality and injury in Clostridium perfringens.
Traci, P. A.; Duncan, C. L.
Applied Microbiology 28 (5) 815-821 (1974) [22 ref. En] [Food Res. Inst. & Dept. of Bacteriol., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

30

[Study of methods of testing disinfectants. II. Carriers of test organisms and their treatment.]
Bisping, W.; Kirpal, G.
Archiv für Lebensmittelhygiene 25 (4) 84-88 (1974) [3 ref. De, en] [Inst. für Mikrobiol. & Tierseuchen, Tierärztliche Hochschule, Hanover, Federal Republic of Germany]

Pieces of wood 2 × 0.8 × 0.4 cm, Al plates 2 × 1 × 0.1 cm and rough-surface ceramic pieces 1.2 × 1.2 × 0.4 cm were contaminated with 16-h broth cultures of Staphylococcus aureus SG 511 or Pseudomonas aeruginosa, both containing 10^8 microorganisms/ml, and the objects were used as models in disinfection experiments with Tego 51 and formaldehyde, both at 4, 2, 1 or 0.5% concn. The end-point method of the German Society for Hygiene and Microbiology [see Deutsche Gesellschaft für Hygiene und Mikrobiologie (1969) Richtlinien zur Prüfung chemischer Desinfektionsmittel, Edition 2. Stuttgart, Federal Republic of Germany; Verlag Fischer], involving determination of disinfectant concn. at which no viable bacteria can be detected on test objects; the contamination reduction method of Schmidhofer et al. [FSTA (1972) 4 10C245]; and an end-point method based on the Schmidhofer technique and involving incubation of rinsings were compared in these experiments. It is concluded from results tabulated in detail that wood and Al, but not ceramic objects are suitable as model test organism carriers; and that the first method is to be preferred to the other two from the viewpoints of economy of time and materials and precision of findings. [See FSTA (1974) 6 1C10 for part I.] SKK

31

[Heat resistance of Clostridium sporogenes 25, cause of blowing of canned vegetable and meat and vegetable preserves.]
Mazokhina, N. N.
Konservnaya i Ovoshchesushil'naya Promyshlennost' No. 6, 34-37 (1974) [Ru] [Vses. Nauchno-issled. Inst. Konservnoi i Ovoshchesushil'noi Promyshlennosti, USSR]

The heat resistance of Cl. sporogenes 25 spores to sterilization temp. of 108°, 115° and 121°C at pH 4.0-5.5 was investigated. Various vegetable and meat and vegetable products were filled into cans of 15-16 g vol.; the products were sterilized; and spores of Cl. sporogenes 25 were inoculated at 5.10^4-1.10^5 spores/can. Temp. of 108°C was maintained for 5 min, 115°C for 2 min and 121°C for 1 min. The cans were then incubated for 14 days at 37°C. The surviving spores were determined by the standard method; the D value (the heating time necessary for reducing the spore count to 1 tenth of the original number was also determined. An expression for the relation between D and pH is given, as well as for calculating the lethal effect of sterilization, with regard to the D value, anaerobic spore count/cm^3 product, product vol. in the can and permissible % of sub-grade products. A method

of calculating the optimal sterilization conditions with respect to pH of the product and heat resistance of the spores is presented. STI

32

[Resistance of Clostridum botulinum spores during the sterilization of vegetable snacks.]
Flaumenbaum, B. L.; Storozhuk, V. N.; Mordvinova, S. A.
Konservnaya i Ovoshchesushil'naya Promyshlennost' No. 8, 37-38 (1974) [Ru] [Odesskii Tekh. Inst. Pishchevoi Promyshlennosti imeni M. V. Lomonosova, USSR]

The resistance of Cl. botulinum spores to high temp. was investigated in 3 kinds of vegetable snacks, using the graph method based on the exponential relationship between the number of surviving cells and the time of heating at 115°, 118° and 121°C. On the basis of the data obtained on spore survival, the heat resistance constants (D and Z) were established. An example is given showing graphic detn. of these constants for canned synthetic caviar (caviar substitute produced from egg-plant). The results of the experiments indicated that the vegetable snacks studied should be sterilized for ≥1 min; 3 min sterilization is considered safe from the point of view of botulism toxin formation in the majority of vegetable preserved. STI

33

[Enterotoxin detection in thermostable Clostridium perfringens type A strains isolated from a food poisoning outbreak.] Enterotoxin-Nachweis bei hitzeresistenten Stämmen von Clostridium perfringens Typ A aus einer Lebensmittelvergiftung.
Katsaras, K.; Siems, H.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IA **229** (3) 409-420 (1974) [50 ref. De, en] [Fachrichtung Lebensmittelhygiene, Freie Univ., Berlin (West)]

From such foods as barbecued chicken, potatoes and peas, 5 Cl. perfringens strains were isolated and were incriminated in the food poisoning of 119 persons in a Berlin (West) conteen. These strains were identified by biological-biochemical and serological reactions as non-haemolytic, thermostable and weak toxin-producing Cl. perfringens type A. The occurrence of erythemal activity after intradermal injection into depilated guinea-pigs demonstrated enterotoxin activity of these strains. This method is a sensitive and specific proof of enterotoxin produced by Cl. perfringens type A. AS

34

Monkey feeding trials in the investigation of the nature of Bacillus cereus food poisoning. [Conference proceedings]
Goepfert, J. M.
IV International Congress of Food Science and Technology **4c**, 1-3 (1974) [En] [Food Res. Inst., Univ. of Wisconsin, Madison, Wisconsin, USA]

Bacillus cereus and B. thuringiensis induce a diarrheagenic response in monkeys similar if not identical to that characteristic of classical food poisoning in man. The involvement of these organisms in food poisoning underscores the necessity of fuller knowledge of the potential problem, particularly in light of the increased use of B. thuringiensis on certain vegetable crops. Variations from the 'classical' symptomatology as are currently occurring in outbreaks in Great Britain and Canada serve to warn that this type of food poisoning may be more common than previously suspected. AS

35

Enterotoxic Clostridium perfringens: specific nature of the strains and how to place the enterotoxic power in a prominent position. [Conference proceedings]
Poncelet, F.; Catteau, M.
IV International Congress of Food Science and Technology **4b**, 20-21 (1974) [En] [Unite de Microbiol. Alimentaire de l'Inst. Pasteur de Lille au CERTIA, rue Jules Guesde, 59650 Villeneuve d'Ascq, France]

Difficulties in rapid identification of food poisoning strains of Clostridium perfringens type A are discussed. Differences from classical strains of Clostridium perfringens in the heat resistance of spores, degree of elaboration of exotoxins and the presence of specific somatic antigens are considered to be of doubtful validity. Laboratory and clinical observations showed that the enterotoxic factor is produced by sporulating cells, which also have strictly specific nutritional needs. A new sporulation medium was developed and used to obtain soluble extracts of sporulating cells containing the toxic factor, the action of which was studied in the rabbit. Results with different strains suggested the possible existence of several enterotoxins. ELC

36

The effect of pH, sodium chloride and sodium nitrite on the heat resistance of Staphylococcus aureus and the growth of damaged cells in laboratory media. [Conference proceedings]
Bean, P. G.; Roberts, T. A.
IV International Congress of Food Science and Technology **4b**, 8-10 (1974) [5 ref. En] [Metal Box Co. Ltd., Res. & Dev. Dept., London, UK]

Sodium chloride alone and in combination with sodium nitrite was shown to increase the heat resistance at pH 6.0-7.0 of an enterotoxin A producing strain of Staphylococcus aureus. Sub-lethal heat damage sensitized cells to NaCl, the degree of sensitization varying with concn. of NaCl during heating and pH of the growth medium. Results indicate that pasteurized cured meats with a final pH of 6.5 or above are predisposed to greater

survival and subsequent outgrowth of Staph. aureus. Storage at below 10°C is recommended for these products. Radiation damaged cells were shown to be more tolerant to combination of curing salts than heat damaged cells. AS

37

The botulism hazard in canned mushrooms - US experiences. [Conference proceedings]
Read, R. B., Jr.; Kautter, D. A.
IV International Congress of Food Science and Technology **4b**, 1-2 (1974) [En] [Food & Drug Administration, Div. of Microbiol., 200 C St., S.W., Washington, DC 20204, USA]

In Jan. 1973 canned mushrooms from a factory experiencing excessive spoilage were found to contain pre-formed type B botulinum toxin; the probable reason for underprocessing was excessively tight packaging of the mushrooms which reduced heat penetration to F_o (121°C) of only 0.01 min. Inspection of all 41 mushroom canners in the USA indicated that some others were not observing the heat processing regulations. Sampling and analysis of swollen cans continued and type B toxin was found in the products of 4 different packers; all suspect goods were recalled and no clinical cases resulted. A comprehensive survey was then made of warehouse stocks and several thousand samples were subjected to detailed inspection and laboratory examination. Approx. 15% of intact cans contained viable Gram positive organisms. Factors influencing the effectiveness of thermal processing in the particular case of mushrooms are suggested. ELC

38

Botulism from marinated mushrooms. [Conference proceedings]
Todd, E.; Chang, P. C.; Hauschild, A.; Sharpe, A.; Park, C.; Pivnick, H.
IV International Congress of Food Science and Technology **4c**, 4-6 (1974) [En] [Microbiol. Div., Food Res. Lab., Health Protection Branch, Health & Welfare Canada, Ottawa, Canada]

As a result of a case of botulism arising from consumption of commercially marinated mushrooms all bottles of the incriminated brand were recalled in Canada and the United States. To determine the extent of the problem all 8656 bottles in Canada were analysed; 11 were found to contain Clostridium botulinum toxin type B. Their contents ranged from pH 4.82 to 6.79 and had a butyric odour. The most likely cause of the outbreak was insufficient acidification of the products. Products containing toxin had a pH >4.75; a pH <4.6 is recommended. AS

39

Characterization of the thermal destruction of enterotoxin B at frying temperatures. [Conference proceedings]
Stinson, J. V.; Troller, J. A.
IV International Congress of Food Science and Technology **4c**, 7-9 (1974) [En] [Procter & Gamble Co., Winton Hill Tech. Center, Cincinnati, Ohio 45224, USA]

Pre-formed staphylococcal enterotoxin B is highly thermostable (e.g. at 100°C) and its inactivation under oil-frying conditions was studied. Rapid but incomplete initial inactivation occurred, followed by a much longer period to complete inactivation. Toxin destruction in a system of a_w 0.99 required 62, 23, 5 and 2.8 min at 121, 135, 149 and 160°C respectively. The lower a_w level of most oil-fried foods is likely to exert some protective effect, but nevertheless some toxin survival is possible under practical conditions. Addition of NaCl resulted in a toxin-protective effect. The initial concn. of toxin was also an important factor. ELC

40

Growth and resistance characteristics of some psychrotrophic sporeformers isolated from raw milk. [Conference proceedings]
Dufeu, J.; Leesment, H.
XIX International Dairy Congress **1E**, 535-536 (1974) [2 ref. En] [Swedish Dairies Assoc., Malmo, Sweden]

The average generation time for 4 Bacillus cereus strains from raw milk increased from 1.3 h at 30°C to 9.1 h at 8°C and 54 h at 3°C. Boiling water and 1% HNO_3 at 60°C had the greatest sporicidal effect (99.9 and 99.7% kill respectively) out of several disinfectants tested. CDP

41

Enteropathogenic properties of staphylococci isolated from milk and milk products. [Conference proceedings]
Kartashova, V. M.
XIX International Dairy Congress **1E**, 393 (1974) [En] [All Union Res. Inst. of Vet. Sanitation, Moscow, USSR]

Double diffusion test, on agar gels containing 3 monospecific enterotoxins antisera (A, B and C), of 71 strains of haemolytic, highly toxinogenic staphylococci (toxin titre ≥1:1280) showed that 19 strains gave precipitation lines with serum A, 6 with B, and 3 with C; i.e. 39.5% of strains were enteropathogenic. Non-enterotoxin-producing staphylococci did not produce precipitation lines. DMK

42

Food poisoning from staphylococcal enterotoxins in cheese. [Conference proceedings]
Miller, F. J.
XIX International Dairy Congress **1E**, 552 (1974) [3 ref. En] [Lab. Enterotox D-4152 Kempen 2, Federal Republic of Germany]

In 22 of 30 cheese samples, each of which caused

sickness in 2-26 persons, serological and biological tests for staphylococcal enterotoxins were positive. Enterotoxin A (sometimes combined with B and D) was found in 12 cheeses, at 4-32 µg 100 g cheese. Concn. of enterotoxins B, C, C D and D were 29-300 µg/100 g. Strains were coagulase and DNAase-positive. DMK

43

Assessment of staphylococcal growth in dairy products for prevention of food poisoning outbreaks. [Conference proceedings]
Tatini, S. R.; Cords, B. R.
XIX International Dairy Congress **1E**, 556-557 (1974) [1 ref. En] [Minnesota Agric. Expt. Sta., Univ. of Minnesota, USA]
See FSTA (1974) 6 4P566.

44

New developments in cheese research.
Morris, H. A.; McKay, L. L.; Tatini, S. R.
Dairy and Ice Cream Field **157** (10) 94, 96, 98, 100-101 (1974) [En] [Dept. of Food Sci. and Nutr., Univ. of Minnesota, St. Paul, Minnesota, USA]

Objectives and findings of a number of research projects in progress at the University of Minnesota are given briefly. The projects cover low-fat cheeses (acceptable Port du Salut, Brick, Swiss and Gouda made from 1.75-2.00% fat milks), high-fat cheeses (e.g. 'Cream Colby' made from 10% fat milk), low-sodium cheese (sodium content reduced by 50%), cheese from casein concentrates, and imitation cheese from coprecipitates. Other studies are concerned with cheese ripening, Staphylococcus aureus in cheese, and improvement of strains of starter cultures. FL

45

Clostridium perfringens in the environment.
Matches, J. R.; liston, J.; Curran, D.
Applied Microbiology **28** (4) 655-660 (1974) [20 ref. En] [Inst. for Food Sci., & Tech., Coll. of Fisheries, Univ. of Washington, Seattle, Washington 98195, USA]

The aerobic count, anaerobic count, total Clostridium count and Clostridium perfringens count of the gut contents of samples of various species of fish (English sole, Parophrys vetulus; ratfish, Hydrolagus colliei; Dover sole, Microstomus pacificus; pacific dogfish, Squalus acanthias; sand sole, Psettichthys melanosticus; pacific hake, Merluccius productus; rockfish, Sebastes spp.; Pacific cod, Gadus macrocephalus; sablefish, Anaoplopoma fimbria) caught in various regions of Puget sound, Washington, USA and surrounding areas were determined. All samples from the area of a sewage outfall contained C. perfringens, at a mean count of 3.4×10^4 g; only 5 of 15 samples from other areas of Puget Sound contained C. perfringens (mean count $(5.0 \times 10^3$/g). No C. perfringens were isolated from samples of fish caught at other locations off the Washington coast. The C. perfringens isolates were serotyped, to determine wether there was any correlation between these types and the serotypes occurring in food poisoning outbreaks in Seattle. Only 18% of the strains could be typed and no correlation was established. AJDW

46

Incidence of Clostridium botulinum in crabmeat from the blue crab.
Kautter, D. A.; Lilly, T. Jr.; LeBlanc, A. J.; Lynt, K. R.
Applied Microbiology **28** (4) 722 (1974) [8 ref. En] [Div. of Microbiol., FDA, Washington, DC 20204, USA]

Brief detail are given of studies on the incidence of Clostridium botulinum in fresh and pasteurized crabmeat from the Blue crab (Callinectes sapidus Rathbun). 986 fresh crabmeat samples (from 40 processors) and 1000 pasteurized crabmeat samples (from 38 processors) were studied. 6 samples fresh crabmeat (from 2 processors) contained C. botulinum, 4 isolates being type E and 2 being proteolytic type B. One sample of pasteurized crabmeat contained a proteolytic strain of C. botulinum type F; this strain was too heat resistant for its spores to be destroyed by pasteurization. AJDW

47

Meat chilling - the first reason why. [Conference proceedings]
Ingram, M.
MRI [Meat Research Institute] Symposium No. 2, 1.1-1.13 (1972) [12 ref. En] [Meat Res. Inst., Langford, Bristol, UK]

The interrelation of factors influencing putrefaction of the deep musculature of beef carcasses by anaerobic bacteria (especially Clostridium perfringens) is discussed with special reference to temp., cooling rate, initial count, redox potential and pH. Quantitative analysis of the inhibitory effects of these factors on the rate of multiplication of clostridia show that traditional cooling procedures would be expected to be incapable of preventing putrefaction, in the absence of other inhibitory factors; the importance of inhibition of clostridia by the high redox potential during the early post-mortem period is stressed, together with the inhibitory effects of the post-mortem muscle pH decline. The adverse effects of pre-slaughter stress on post mortem muscle pH and redox potential are discussed; it is suggested that meat from stressed animals is likely to be more susceptible to putrefaction that that from non-stressed animals. Problems of putrefaction of liver and bone marrow are also briefly discussed. AJDW

48

Behavior of Clostridium perfringens in precooked chilled ground beef gravy during cooling, holding, and reheating.
Tuomi, S.; Matthews, M. E.; Marth, E. H.
Journal of Milk and Food Technology **37** (10) 494-498 (1974) [14 ref. En] [Dept. of Food Sci., Univ. of Wisconsin-Madison, Madison, Wisconsin 53706, USA]

The suitability of handling practices used in school kitchens was evaluated using ground beef gravy that was contaminated with Clostridium perfringens. Cooked gravy was cooled to 43.5°C and inoculated with a mixture of vegetative cells and spores of Cl. perfringens NCTC 8239 to provide approx. 10 000 organisms/g. After inoculation, gravy was packed in bags, refrigerated for 16 h, held for 5 h at 28° or 5.5°C, and then heated in a compartment steamer for 35 min or until the temp. of the gravy at the centre of the pan reached 74°C. Cl. perfringens was enumerated at intervals during cooling, holding, and heating of the gravy. The number of viable cells after 16 h of refrigeration at 5.5°C was influenced by the first 6 h of cooling when the temp. of the gravy was in the range that permitted growth of Cl. perfringens (18.5-50°C). Plate counts of gravy held for 5 h at 28° or 5.5°C indicated stabilization of the Cl. perfringens population. When 74°C was the final temp. to which the gravy was heated, no viable cells of Cl. perfringens were found. AS

49

A putrefactive anaerobic bacteria as a reason for the spoilage of 'Salchichon' cured sausages.
[Conference proceedings]
Garcia-Pina, J.; Urgell, J. B.
IV International Congress of Food Science and Technology **4b**, 35-37 (1974) [En] [Lab. Miret, SA (Lamirsa), Microbiol. Div. Poligone Ind. Can Parellada, Les Fonts, Tarrasa, Barcelona, Spain]

The development of a white core ('taca') in 'Salchichon' sausages shortly after curing, followed later by blackening and putrefaction, is an important commercial problem. Comparisons between sound and defective sausages indicated that the defect is associated with the presence of large numbers (10^7 cells/g) of a strictly anaerobic spore-forming Clostridium sp. with an optimum growth temp. of 30°C and capable of survival at low pH (4-5). The organism occurs in some of the raw materials and effective control methods must be applied at this level. ELC

50

Studies on Staphylococcus aureus in poultry bruises.
[Conference proceedings]
Hamdy, M. K.; Roskey, C.
IV International Congress of Food Science and Technology **4c**, 10-12 (1974) [11 ref. En] [Dept. of Food Sci., Univ. of Georgia, Athens, Georgia 30602, USA]

Examinations were made of swabs taken from hands of workers on a poultry processing line, including infected lacerations and exudates, and from normal and bruised poultry tissue. Staphylococcus cultures (170) were isolated and characterized. Staph. aureus was found in 86.6% of swabs from infected hands, in 40% from hands of workers handling bruised birds and in 38.7% from bruised tissues, but was absent from hands of workers not handling bruised birds. The same phage-type Staph. aureus was found in poultry bruises, on hands of workers handling bruised birds and in infected hand lesions; it is concluded that the bruises are a source of infection of poultry workers. There was some evidence that staphylococcal growth was more vigorous in bruised and early healing tissues than in normal tissue. ELC

51

Inhibition of coagulase activity and growth of Staphylococcus aureus by garlic extracts.
Fletcher, R. D.; Parker, B.; Hassett, M.
Folia Microbiologica **19** (6) 494-497 (1974) [8 ref. En] [Dept. of Microbiol., School of Dental Med., Univ. of Pittsburgh, Pennsylvania 15261, USA]

52

Recovery of heated Clostridium perfringens type A spores on selective media.
Barach, J. T.; Adams, D. M.; Speck, M. L.
Applied Microbiology **28** (5) 793-797 (1974) [19 ref. En] [Dept. of Food Sci., N. Carolina St. Univ., Raleigh, N. Carolina 27607, USA]

The enumeration of Cl. perfringens spores on sulphite/polymyxin/sulphadiazine agar (SPS), tryptone/sulphate/neomycin agar (TSN), Shahidi-Ferguson perfringens agar (SFP), tryptone/sulphite/cycloserine agar (TSC) and TSN lacking antibiotics (BASE) was studied. The spores were heated at 105-120°C by the capillary-tube method. The media were about equally efficient for enumeration of heat-activated spores, but efficiency for recovery of spores surviving UHT treatments was in the following order: TSC ≥ SFP > BASE > SPS > TSN. Greater recoveries on TSC or SFP were attributed to germination of injured spores by lysozyme present in the egg yolk emulsion used in these media. Low recovery of survivors on TSN and SPS was due to both the absence of lysozyme and inhibition of injured spores by the selective agents of these media. Recovery of heated spores was reduced greatly by polymyxin, neomycin and kanamycin, and slightly by sulphadiazine and D-cycloserine. Addition of lysozyme to SPS or TSN did not improve the % of heat-injured spores recovered because the selective agents of these media interfered with the action of lysozyme. The suitability of the selective media for the

enumeration of survivors was greatly affected by the presence of certain foods (milk, tomato extract and meat broth). AS

53

Clostridium botulinum in Scottish fish farms and farmed trout.
Burns, G. F.; Williams, H.
Journal of Hygiene 74 (1) 1-6 (1975) [18 ref. En] [Microbiol. Lab., Highland Health Board, Inverness, UK]

Samples of rainbow trout, bottom mud and feed from 3 trout farms were tested for Clostridium botulinum. C. botulinum was detected only in samples from one trout farm, one fish of 21 tested at this farm being C. botulinum-positive. 9 of 37 bottom mud samples from this farm were also C. botulinum-positive. All were non-proteolytic C. botulinum type B. The public health implications of the presence of C. botulinum in fish and the bottom mud of fish farm ponds are briefly discussed. AJDW

54

The incidence of Clostridium botulinum in Danish trout farms. I. Distribution in fish and their environment.
Huss, H. H.; Pedersen, A.; Cann, D. C.
Journal of Food Technology 9 (4) 445-450 (1974) [11 ref. En] [Min. of Fisheries, Tech. Univ., Lyngby, Denmark]

Examination of 4 Danish trout farms demonstrated the presence of Clostridium botulinum in trout, the wet-fish feed, farm waters, pond muds and invertebrates, and in soil around the farm. The incidence in 530 trout examined varied from 5-100% in winter to 85-100% in late summer. Clostridium botulinum type E was the predominant type found. AS

55

The incidence of Clostridium botulinum in Danish trout farms. II. Measures to reduce contamination of the fish.
Huss, H. H.; Pedersen, A.; Cann, D. C.
Journal of Food Technology 9 (4) 451-458 (1974) [11 ref. En] [Min. of Fisheries, Tech. Univ., Lyngby, Denmark]

Experiments were carried out to develop methods for reducing Clostridium botulinum contamination of farmed trout. Starvation studies gave variable results. When carried out under hygienic conditions in artificial containers and a clean water supply, contamination was reduced. Gutting of fish by hand or machine always reduced contamination to a low level. Quick-liming effectively reduced contamination of pond bottoms and may be a useful control measure against Clostridium botulinum. AS

56

Botulism in farmed trout caused by Clostridium botulinum type E.
Huss, H. H.; Eskildsen, U.
Nordisk Veterinaermedicin 26 (12) 733-738 (1974) [7 ref. En, da] [Tech. Lab., Min. of Fisheries, Tech. Univ., Lyngby, Denmark]

Brief details are given of an outbreak of botulism in trout at a fish farm in Denmark; the outbreak was traced to trash-fish based feed containing Clostridium botulinum toxin. The presence of Cl. botulinum and its toxin in trout for human consumption is briefly discussed with reference to possible health hazards. AJDW

57

[Examination of staphylococci from the thaw water of frozen poultry.] Untersuchungen an Staphylokokken aus dem Auftauwasser von Gefriergeflügel.
Kusch, D.; Götze, U.
Fleischwirtschaft 54 (12) 1960-1962, 1965 (1974) [27 ref. De, en, fr] [Inst. für Lebensmittelhygiene, Fleischhygiene & -tech., Freie Univ., 1000 Berlin (West) 33, Bitterstrasse 8-12]

209 strains of staphylococci were isolated from the thaw water from 75 roasting chickens, 60 ducks and 44 turkeys, using selective media containing egg yolk. Coagulase, DNAase, fibrinolysin, lysozyme and haemolysin production were evaluated, crystal violet reaction was determined, resistance to penicillin, streptomycin, bacitracin, oleandomycin and tetracycline was tested, and the strains were lysotyped using the International Basic Collection. The strains showed similarities to isolates from human sources. 74.2% could be typed from the International Basic Collection, and their lysis group distribution closely resembled that of strains from human sources. Tetracycline resistance was fairly commonly observed, probably due to presence of this antibiotic in feeds. The results indicate that man is the most common source of staphylococcal contamination of poultry, which probably occurs at a pre-slaughter stage. The health hazard from staphylococci in poultry is discussed. AS

58

Survival of Clostridium perfringens on chicken cooked with microwave energy.
Blanco, J. F.; Dawson, L. E.
Poultry Science 53 (5) 1823-1830 (1974) [22 ref. En] [Dept. of Food Sci. & Human Nutr., Michigan St. Univ., East Lansing, Michigan 48824, USA]

Chicken pieces, which had been inoculated with spores or vegetative cells of heat resistant or heat sensitive strains of Clostridium perfringens, were cooked in a microwave oven and browned in corn oil. The effects of freezing, thawing and frozen

storage before and after microwave cooking on recovery of vegetative cells and spores were evaluated. Microwave cooking resulted in a two log cycle reduction in resident vegetative and inoculated C. perfringens cells. When chicken pieces were frozen and thawed, prior to microwave cooking, a greater reduction of the microbial load after cooking was found for both cells and spores of C. perfringens. Reduction of spores by microwave energy was minimal, however, the cooking environment provided an efficient activation and germination step. Cells or spores of C. perfringens were not recovered after microwave cooking followed by browning in heated vegetable oil at 190.5°C. AS

59

Rabbit immunization with foreign proteins, obtention of antiserum and the immunodiffusion in slide. [Conference proceedings]
Langner, H. J.
IV International Congress of Food Science and Technology Abstracts of Papers **9a**, 216 (1974) [En] [Inst. für Lebensmittelhygiene, Fleischhygiene u. -technologie, FU Berlin, 1 Berlin (West) 33, Bitterstr. 8-12]

This is a film demonstrating the serological detection of foreign proteins and bacterial toxins in food. HBr

60

The reliability of selective media for the enumeration of unheated and heated staphylococci.
Stiles, M. E.; Clark, P. C.
Canadian Journal of Microbiology **20** (12) 1735-1744 (1974) [48 ref. En, fr] [School of Household Economics, Univ. of Alberta, Edmonton, Alberta T6G 2E2, Canada]

The relative efficiency of 15 selective media for enumerating unheated and sublethally heated (10, 20 and 30 min at 54.5°C in 10% reconstituted dried skim-milk) strains of Staphylococcus aureus was tested against tryptic soya agar (Difco). Baird-Parker's egg yolk/tellurite/glycine/pyruvate agar was found to be the best medium for both unheated and sublethally heated cells.
Tellurite/polymyxin/egg yolk agar and egg yolk/azide agar also gave favourable results. For unheated cells, Vogel-Johnson agar and tellurite/glycine agar gave satisfactory results, but after heat treatment, even after a 10-h enrichment in tryptic soya broth for resuscitation of the heat injury, these media gave unreliable counts. Egg yolk acted not only as a diagnostic, but also as a protective agent in selective media for staphylococci. The protective action of egg yolk was more effective in azide- and tellurite-containing selective media than in salt-containing selective media. AS

61

Evaluation of some methods for the isolation and identification of pathogenic staphylococci.
Oluski, A. A.
Acta Veterinaria, Yugoslavia **24** (5) 237-244 (1974) [11 ref. En, sh] [Jugoslovenski Inst. za Tehnologiju Mesa, 11000 Belgrade, Yugoslavia]

Baird-Parker (BP), Vogel and Johnson (VJ), tellurite/polymyxin/egg yolk (TPEY), and Chapman media were compared with media containing lecithin instead of egg yolk (BP/LC and TPEY/LC media). Only 5 of 12 kinds of lecithin could be used in the media, and properties of the lecithin-containing media were improved by addition of β-carotene. VJ, Chapman and TPEY/LC were significantly less suitable ($P < 0.01$) than BP medium for the isolation of pathogenic staphylococci from experimentally contaminated meat, whilst BP/LC and TPEY media did not differ significantly from BP medium. The % of colonies, isolated from chilled, frozen and cooked (60°C for 30 min) meats respectively, which were also coagulase-positive were: on BP medium, 81.5, 75 and 70.9; VJ medium, 80, 78.5 and 68; Chapman medium, 33.6, 25 and 26; TPEY, 100, 100 and 98; BP/LC, 95.2, 100 and 100; and TPEY/LC; 91.3, 100 and 100. CDP

62

Hazard analysis of Clostridium perfringens in the Skylab food system.
Bourland, C. T.; Heidelbaugh, N. D.; Huber, C. S.; Kiser, P. R.; Rowley, D. B.
Journal of Milk and Food Technology **37** (12) 624-628 (1974) [12 ref. En] [Tech. Incorporated, Life Sci. Div., 17311 El Camino Real, Houston, Texas 77058, USA]

The Skylab Food System presented unique microbiological problems because food was warmed in null-gravity (diminished convection) and potentially diminished conduction (poor surface contact), and because the heat source was limited to 69.4°C (to prevent boiling in null-gravity in the approx. one-third atm total pressure). Thus, foods were manufactured using critical control point techniques of quality control coupled with appropriate hazard analyses. One of these hazard analyses evaluated the threat from Clostridium perfringens. Samples of food were inoculated with C. perfringens and incubated for 2 h at 25-55°C. Generation times were determined for the foods at various temp. Results of these tests were evaluated taking into consideration: food-borne disease epidemiology, the Skylab food manufacturing procedures, and the performance requirements of the Skylab Food System. Based on this hazard analysis, a limit for C. perfringens of 100/g was established for Skylab foods. AS

63

Staphylococcus aureus growth and survival in macaroni dough and the persistence of enterotoxins in the dried products.
Lee, W. H.; Staples, C. L.; Olson, J. C., Jr.
Journal of Food Science 40 (1) 119-120 (1975) [14 ref. En] [Food & Drug Administration, 200 C St. S. W., Washington, DC 20204, USA]

Enterotoxigenic strains of Staphylococcus aureus, tap water and semolina were blended together to study the potential for growth and enterotoxin formation in pasta dough. S. aureus grew well in a lump of wet dough or noodle-shaped product with or without 5.5% egg yolk. Enterotoxins A and C were detected repeatedly in dough after 14-30 h of incubation at 25° and 35°C. With an initial population of 10^9/g, S. aureus was nonviable after 6 months storage at 25°C. In contrast, enterotoxins A and C and Salmonella typhimurium cells were stable in the dried products and were recovered after 1 yr of storage. IFT

64

Enterotoxin production potential of Staphylococcus aureus in fluid milk products.
Sheikh, M. I.
Dissertation Abstracts International, B 35 (1) 309: Order No. 74-16396 (1974) [En] [Washington St. Univ., Pulman, Washington, USA]

Of 8 coagulase-positive Staph. aureus strains isolated from commercially processed fluid dairy products and non-dairy whip, 1 was enterotoxigenic and produced enterotoxin C. None of the Staph. aureus strains survived heating for 30 min at 62.8°C in sterile or raw milk. Staph. aureus 100, which produces enterotoxin A, grew better at 37°C and formed more enterotoxin ($P < 0.05$) in skim- and whole milk than in half-and-half and whipping cream; none of these 4 products supported growth of Staph. aureus when incubated at 22°C for 16 h. CDP

65

6 P 1397
Inhibition of bacteria by some volatile and non-volatile compounds associated with milk. III. Staphylococcus aureus.
Kulshrestha, D. C.; Marth, E. H.
Journal of Milk and Food Technology 37 (11) 545-550 (1974) [18 ref. En] [Dept. of Food Sci. & Res. Inst., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Growth inhibition of Staphylococcus aureus by milk associated compounds [FSTA (1971) 3 2P368] was determined as in the preceding 2 abstr. The most inhibitory compounds, at concn. of ≤10 ppm, were formic, acetic, butyric, hexanoic, octanoic and decanoic acids, formaldehyde, acetaldehyde, propionaldehyde and glyoxal. Other compounds tested had little effect except at high concn., where pH effects may have contributed to inhibition by some acids and amines. MJL

66

A solid-phase radioimmunoassay for the detection of staphylococcal enterotoxins in dairy products.
Jarvis, A. W.
New Zealand Journal of Dairy Science and Technology 9 (2) 37-39 (1974) [3 ref. En] [New Zealand Dairy Res. Inst., Palmerston North, New Zealand]

The method consists essentially of addition of ^{125}I-labelled enterotoxin B to a polystyrene tube which has been coated with enterotoxin antiserum; after incubation at 37°C sufficient time to allow adsorption to the antibody, excess enterotoxin is removed by washing, and the amount of adsorbed antigen is measured by radioactive count. When food samples are added to the tube before the labelled antigen, any enterotoxin present will adsorb onto the antiserum, thus leaving fewer binding sites for the labelled antigen; the amount of unlabelled antigen can then be estimated from the reduction in radioactive count by reference to a standard curve. This method could be used to detect as little as 0.006 µg enterotoxin/g in Cheddar cheese and dried milk; this represented a 200-fold increase in sensitivity over tube or slide gel-diffusion immunoassays. 84% of added toxin was recovered from dried milk. CDP

67

Temperature profiles during commercial pasteurization of meat from the blue crab.
Dickerson, R. W., Jr.; Berry, M. R., Jr.
Journal of Milk and Food Technology 37 (12) 618-621 (1974) [6 ref. En] [Food Eng. Branch, Bureau of Foods, FDA, US Dept. of Health, Education, & Welfare, Cincinnati, Ohio 45226, USA]

Crab meat is pasteurized to inactivate most of the spoilage microorganisms, so extending its shelf life under refrigeration, but the process is not intented to achieve commercial sterility. To determine if spores of Clostridium botulinum would survive the process, crab meat temp. were measured during commercial pasteurization by different US processors. Cans of crab meat were instrumented with thermocouples, and heating curves were recorded. Water bath temp. were reasonably constant among the different processors, i.e. 186°-189°F. Holding times were more variable (92-150 min). Lethality of the lowest thermal process was estimated to be equivalent to 18 min at 180°F. AS

68

[A bacteriological study on the keeping quality of Vienna sausages. III. Inhibitory effects of furylfuramide, sorbic acid and nitrite upon growth of Clostridium welchii.]
Konuma, H.; Suzuki, A.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 15 (4) 243-251 (1974) [21 ref. Ja, en] [Nat. Inst. Hygienic Sci., Kamiyoga 1-chome, Setagaya-ku, Tokyo, Japan]

Anaerobic bacteria isolated from commercial samples of Vienna sausages were identified as thermolabile Clostridium welchii. Furylfuramide at a concn. of 0.31-1.25 ppm was effective for inhibition of in vitro growth of the isolated C. welchii. The inhibitory effects of nitrite and sorbic acid were also studied. [See also preceding abstr.] TM

69

[The bacteriology of Mettwurst. I. Occurence and properties of coagulase-positive staphylococci.]
Beiträge zur Bakteriologie der frischen Mettwurst 1. Mitteilung: Vorkommen und Eigenschaften koagulasepositiver Staphylokokken.
Sienes, H.; Sinell, H. J.
Fleischwirtschaft **54** (11) 1789-1792, 1795-1796 (1974) [35 ref. De, en, fr] [Inst. für Lebensmittelhygiene, Fleischhygiene und -tech., Freie Univ., Berlin (West) 33]

A total of 104 samples of commercially-produced Mettwurst were examined for egg yolk-positive staphylococci; samples included (i) fresh Mettwurst; (ii) Mettwurst stored for ≤2 wk at 6°C and (iii) Mettwurst stored for ≤2 wk at room temp. (22°C). 20 (ii) samples and 19 (iii) samples contained egg yolk-positive and coagulase-positive staphylococci. Most samples contained <1000 egg yolk-positive staphylococci/g; several (iii) samples contained ≤4 × 10^6/g. A total of 161 egg yolk-positive strains were isolated; 145 were coagulase-positive. The strains were evenly distributed over phage groups I and III. Testing of antibiotic resistance showed that 30% were resistant to all 12 antibiotics tested, and 44.2% showed multiple resistance to up to 6 antibiotics. It is considered that Mettwurst represents no significant health hazard. RM

70

Incidence and viability of Clostridium perfringens in ground beef.
Ladiges, W. C.; Foster, J. F.; Ganz, W. M.
Journal of Milk and Food Technology **37** (12) 622-623 (1974) [4 ref. En] [Food Hygiene Div., Letterman Army Inst. of Res., Fitzsimons Army Med. Center, Denver, Colorado 80240, USA]

The incidence of Clostridium perfringens in 95 ground beef samples obtained from a retail store in Denver, Colorado was 47.4%. Although viability was not reduced after 24 h at -20%C, >90% of the organisms usually could not be detected after frozen storage over a 4-month period. AS

71

[Connection between accumulation of enterotoxin A and quantity of pathogenic staphylococci in meat dishes.]
Bugrova, V. I.; Petrushina, L. I.; Nikolaeva, I. S.
Voprosy Pitaniya No. 1, 62-66, 94 (1975) [7 ref. Ru, en] [Inst. Pitaniya AMN SSSR, Moscow, USSR]

Raw mock-cutlets (from minced meat) were steam-cooked in the laboratory, and contained at this stage 400-750 sporeformer cells/g; their surfaces were then sprayed at the rate of 5000 cells/g with a suspension of Staphylococcus sp. strain 3278 (isolated from sprats in oil, involved in an outbreak of food poisoning) from the authors' Institute's collection, and known to produce enterotoxin A; and the cutlets were incubated at (i) 26°C or (ii) 37°C for 6-48 h. At (i), contents of staphylococci reached 8-20 million/g after incubation for 12 h, and at (ii) they reached 3-30 million/g in 6-8 h. At these stages, enterotoxin A could be demonstrated in the cutlets by gel diffusion and by biological tests on cats; and thereafter enterotoxin content increased with increase in numbers of staphylococci. SKK

71

The effect of nitrite on botulinal toxin formation in bacon. [Conference proceedings]
Greenberg, R. A.
Proceedings of the Meat Industry Research Conference pp. 69-70 (1973) [En] [Res. & Development Center, Swift & Co., Oak Brook, Illinois 60521, USA]

Brief details are given of a study on factors influencing growth and toxin production by Clostridium botulinum in bacon. Factors studied were initial nitrite concn. (0, 30, 60, 120, 170 or 340 ppm), inoculum size (200 spores/g or 22 600 spores/g) and inoculation time (before or after curing). The bacon samples were then incubated at 80°F, and tested for toxin at intervals. With the lightly inoculated product, toxin formation decreased with increasing nitrite level, and no toxin was formed in samples made with 170 or 340 ppm nitrite. With the heavily-inoculated sample, toxin formation occurred at all levels of added nitrite, but with decreasing frequency as the nitrite level increased. Time of inoculation had no effect on toxin formation. Residual nitrite disappeared rapidly during incubation of the bacon. The possible presence of a Perigo factor in bacon is briefly discussed. AJDW

72

Enumeration of Bacillus cereus and its serotaxonomy based on the expsporium antigen.
Kim, H. U.
Dissertation Abstracts International, B **35** (8) 3734: Order no. 74-24732 (1975) [En] [Wisconsin Univ., Madison 6, Wisconsin, USA]

Studies on the development of an enumeration technique for Bacillus cereus and a rapid confirmatory test for this organism are described. A new selective medium 'KG medium' was developed; recovery and selectivity were equivalent to those of the existing MYP medium. KG medium also allows free spore formation, and permits testing of the lecithinase reaction of the bacteria. Heat resistant antigens on the exosporium were found to be valuable for serotaxonomy of the B. cereus group by the fluorescent antibody method; studies were conducted with 57 B. cereus group isolates and a total of 49 antisera. Applications of these methods in food hygiene studies are briefly discussed. AJDW

73

[Germination of spores of Clostridium species capable of causing food poisoning. III. Effect of some food additives on the germination of spores of Cl. botulinum type E.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **15** (4) 292-296 (1974) [10 ref. Ja, en] [Hokkaido Inst. of Public Health, Nishi 12, Kita 19, Kita-ku, Sapporo, Japan]
NaCl at a concn. of 3% and $NaNO_2$ at a concn. of 1% inhibited germination. [See FSTA (1974) **6** 12C410 for part II.] TM

74

[Germination of spores of Clostridium species capable of causing food poisoning. IV. Effect of boticin E on the germination of spores of Cl. botulinum type E.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **15** (4) 297-300 (1974) [6 ref. Ja, en] [Hokkaido Inst. of Public Health, Nishi 12, Kita 19, Kita-ku, Sapporo, Japan]
Partially purified boticin E was much less active in inhibiting spore germination than crude boticin E. The former at a concn. of 20 units repressed outgrowth rather than inhibiting germination. TM

75

[Germination of spores of Clostridium species capable of causing food poisoning. V. Ionic germination of spores of some heat-sensitive strains of Cl. perfringens Type A.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **15** (5) 373-376 (1974) [10 ref. Ja, en] [Hokaido Inst. of Public Health, Kita-ku, Kita 19, Nishi 12, Sapporo, Japan]
Spores of 3 heat-sensitive strains of Cl. perfringens Type A which were heat-shocked at 80°C for 10 min underwent so-called 'ionic germination' in aqueous solutions composed of divalent and monovalent alkali metal chlorides. Germination was most remarkable in a solution composed of $CaCl_2$, NH_4Cl and NaCl; the chloride ion was shown to be essential for germination. TM

76

[Germination of spores of Clostridium species capable of causing food poisoning. VI. Effect of some food additives on the germination of spores of a heat-sensitive strain of Cl. perfringens Type A.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **15** (5) 377-380 (1974) [5 ref. Ja, en] [Hokkaido Inst. of Public Health, Kita-ku, Kita 19, Nishi 12, Sapporo, Japan]
A medium containing NaCl in a concn. of not more than 2% stimulated germination of a heat-sensitive strain of Cl. perfringens Type A, but inhibited germination at higher concn. Outgrowth of spores was completely prevented by 6% NaCl. 0.06% $NaNO_2$ also prevented outgrowth. TM

77

[Microorganisms causing food poisoning.]
Mikrobielle "Lebensmittelvergifter". [Review]
Mohs, H.-J.
Gordian **74** (6) 221-223 (1974) [15 ref. De, en] [Co-op Zentral-Lab., Hamburg, Federal Republic of Germany]

78

Detecting the enterotoxigenicity of Staphylococcus aureus strains.
Robbins, R.; Gould, S.; Bergdoll, M.
Applied Microbiology **28** (6) 946-950 (1974) [11 ref. En] [Food Res. Inst., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]
Small vol. of relatively conc. enterotoxin, produced by semi-solid, cellophane-over-agar or sac-culture techniques, are identified by an optimal sensitivity plate (OSP) method. The OSP method is a modified Ochterlony method in which antiserum to a particular enterotoxin is placed in the centre well, the same enterotoxin (control) in 2 outer wells and the unknown enterotoxin in the other 4 outer wells, such that each unknown enterotoxin is adjacent to a control. Plates are prepared with antisera to each enterotoxin being investigated. The unknown enterotoxins are identified from precipitation lines formed between toxin and serum wells after 18 h at 37°C, and confirmed by the line of identity between unknown and control enterotoxins in adjancent wells. Floodin plates with 0.1M H_3PO_4 increases visibility of the lines. The method is suitable for examining large numbers of staphylococcal strains for production of enterotoxins A-E. CDP

79

Comparative study for isolation and enumeration of food poisoning Staphylococcus aureus on Baird-Parker and Giolitti-Cantoni media from soft cheeses.
Takacs, J.; Domjan, K. H.
Archiv für Lebensmittelhygiene **25** (10) 219-222 (1974) [6 ref. En, de] [Central Lab. of Vet. Meat Control Service, Budapest, Hungary]
The following media were compared for isolation and enumeration of Staph. aureus from soft cheese: Giolitti & Cantoni medium with or without 0.025% agar (GC); Baird-Parker agar without sulphamezathine (ETGPA), prepared with or without BBL dehydrated base: Bojanovsky's fluid enrichment medium prepared from 3% (w/v) potassium sulphocyanate in nutrient broth (PSFE); and 5% (v/v) defibrinated bovine or ovine blood agar (BA). The cheese samples had been experimentally contaminated with 100-10 000 Staph. aureus (Jordan strain)/ml. Recoveries on

BA were higher than on GC (liquid and solid) and in PSFE; PSFE exerted a bacteriostatic effect and the staphylococci were recovered only after transfer to BA. Recoveries on ETGPA, particularly when prepared with BBL dehydrated base, were only slightly less than on BA. Since pH of white cheese in brine was 4-5, at which level Proteus spp. are inhibited, inclusion of sulphamezathine in the Baird-Parker medium was not necessary. CDP

80

Effect of smokehouse temperature, humidity and air flow on smoke penetration into fish muscle.
Chan, W. S.; Toledo, R. T.; Deng, J.
Journal of Food Science 40 (2) 240-243 (1975) [10 ref. En] [Food Sci. Dept., Univ. of Georgia, Athens, Georgia 30602, USA]

Smoke flavour has been related directly to concn. of absorbed phenolic compounds. When filleted fish were smoked under controlled temp. and RH <80%, rate of absorption of phenolics generally was very rapid initially followed by gradual decrease until saturation concn. was reached. Saturation concn. and smoking time necessary to achieve this level was a function of smoke temp., RH and air flow. At air flows equivalent to 10 air changes in the smokehouse/min, temp. of 100-200°F, and RH of 22%, saturation was achieved within 3 h of smoking. At 60% RH, saturation concn. of phenolics in flesh increased with increasing temp. ≤160°F and decreased with increasing temp. >160°F. At 80% RH, absorption rate was generally slower and saturation concn. were not achieved within the time interval where saturation was attained at lower RH. Smoke penetration was very slow in still air. Phenolics were absorbed primarily on the first 0.125 in layer from the surface. Temp. change within the fillet was a broken heating curve when plotted on semi-logarithmic coordinates against smoking time. Temp. increase slowed down when fillet temp. equalled wet bulb temp. Smoking for 20 min at 160°F dry bulb and 140°F wet bulb (60% RH) followed by 40 min at 200°F dry bulb and 190°F wet bulb (80% RH) allowed sufficient heat treatment for 12D inactivation of Clostridium botulinum type E and allowed sufficient smoke absorption for flavour.
IFT

81

Fish farms and botulism.
Anon.
British Medical Journal 2 (5963) 106 (1975) [3 ref. En]

Problems of contamination of fish and fish products with Clostridium botulinum are discussed, with reference to detection of C. botulinum in fish products in the N. Pacific region, herrings caught in Norwegian waters, fish farms in the UK and the Federal Republic of Germany, and vacuum-packaged smoked trout in the Federal Republic of Germany. Effects of smoke constituents on the germination of C. botulinum spores in salmon tissue are also discussed. AJDW

82

[Radiosensitivity of anaerobic bacteria causing spoilage of foods.]
Yamazaki, K.; Gotoh, A.; Oka, M.
Food Irradiation [Shokuhin-Shoshu] 9 (1/2) 35-42 (1974) [7 ref. Ja, en] [Tokyo Metropolitan Isotope Res. Center, Tokyo, Japan]

The sensitivity to γ-irradiation of several anaerobes isolated from meat and fish products was studied. Dose survival curves of some anaerobes and clostridial spores isolated from foods are presented. Tables list the radiosensitivity (D_{10} value) of anaerobes isolated from fish and meat products, and the radioresistance, expressed in terms of dose required to give 0.01% reduction in survival, of some clostridial spores. [From En summ.] AL

83

Food poisoning and food hygiene. [Book]
Hobbs, B. C.
Ed. 3, ix+308pp. ISBN 0-7131-4216-2 (1974) [En] London, UK; Edward Arnold (Publishers) Ltd. Price £4.50 [Food Hygiene Lab., Central Public Health Lab., London, UK]

The aim of this book is to bring essential facts about food poisoning and its prevention to everyone engaged in food processing. This revised 3rd edition [see FSTA (1969) 1 1C19 for the 2nd edition] contains 2 parts: Food poisoning and food-borne infection (pp. 1-120) and Food hygiene in the prevention of food poisoning (pp. 121-290). Individual chapters are: Introduction (pp. 3-11); Elementary bacteriology (pp. 12-21); Bacterial causes of food poisoning (pp. 22-30); Reservoirs of infection and ways of spread (pp. 31-44); The vehicle of infection (pp. 45-67); Examples of outbreaks of food poisoning (pp. 68-103); Ecology of micro-organisms in food (pp. 104-110); Food-borne infection (pp. 111-120); Introduction (pp. 123-126); Personal hygiene of the food handler (pp. 127-135); Storage and preparation and retail shops (pp. 136-162); Cleaning methods (pp. 163-182); Sterilization and disinfection, by I. M. Maurer (pp. 183-191); Kitchen design and equipment, by L. Kluth (pp. 192-215); Control of infestation, by L. Kluth (pp. 216-226); Legislation, by L. Kluth (pp. 227-238); and Education (pp. 239-257). Appendix A (pp. 258-287) gives suggested outlines for lectures to various groups of people, and Appendix B (pp. 288-290), entitled 'Prevention of food poisoning abroad', is intended to help travellers with their choice of food. JA

84

[Germination of spores of Clostridium spp. capable of causing food poisoning. VII. Ionic germination of spores of heat-resistant strains of Clostridium perfringens type A.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 16 (1) 25-29 (1975) [5 ref. Ja, en] [Hokkaido Inst. of Public Health, Kita-ku, Kita 19, Nishi 12, Sapporo, Japan]

Germination requirements for spores of heat-resistant strains of Cl. perfringens type A were examined. The spores underwent ionic germination in aqueous solutions of chlorides of monovalent

alkali metals or divalent alkali earth metals. Germination in Na salts was inferior to that in K salts with either inorganic or organic anions. Max. germination took place under the following conditions: heat-shocking of spores at 75°C for 10 min, incubation at 40°C and KCl concn. of 50mM. [See Journal of the Food Hygienic Society of Japan (1974) **15** (5) 377-380 for part VI.] TM

85

[Germination of spores of Clostridium spp. capable of causing food poisoning. VIII. Effects of some chemicals on the spores of a heat-resistant strains of Clostridium perfringens type A.]
Ando, Y.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **16** (1) 30-33 (1975) [4 ref. Ja, en] [Hokkaido Inst. of Public Health, Kita-ku, Kita 19, Nishi 12, Sapporo, Japan]

The effects of some chemicals on the germination of and outgrowth from spores of a heat-resistant strain of Cl. perfringens type A were studied. NaCl concn. up to 8% had no apparent effect on the extent of germination, but >4% reduced the initial rate of germination to some extent. Outgrowth was completely prevented at concn. >5%. The effects of sodium nitrite and potassium sorbate were also investigated. [See preceding abstr. for part VII.] TM

86

[Food poisoning by Clostridium botulinum and Cl. perfringens.] [Lecture]
Hoch, R.; Novotny, T.; Ormay, L.
Konzerv-es Paprikaipar Special issue, pp. 46-50 (1974) [21 ref. Hu, ru, de] [Orsz. Elelmezes- es Taplalkozastudomanyi Intezet, Budapest, Hungary]

This paper presents tabulated data on the occurrence of clostridial food poisoning in Hungary between 1960 and 1973. Cl botulinum was responsible for the poisoning in 9 cases involving 19 persons, and Cl. perfringens in 45 cases involving 2627 persons. Of these latter cases, 30 (involving 1915 persons) were caused by consumption of boiled or fried meat, 9 (346 persons) by smoked meat, 2 (72 persons) by dairy products, 1 (223 persons) by vegetables, 2 (68 persons) by pastries, and 1 (3 persons) was due to other food. Meat products responsible for Cl. botulinum poisoning were mostly prepared in private households. With the extension of foods sold in vacuum-packages and of public catering industry, the increase of poisoning due to Cl. perfringens appears to be likely. [See also author index under **Hungary**, 6th Conference on Hygiene in the Preservation Industry [Symposium].] IF

87

[Pastry creams and public health. I. Outbreak of food-borne type A staphylococcal enterotoxin poisoning caused by pastry cream.]
Catsaras, M.; Seynave, R.; Sery, C.
Annales de l'Institut Pasteur de Lille **21**, 177-192 (1970) [5 ref. Fr, en] [Centre d'Enseignement et de Recherches de Bact. Alimentaire, Inst. Pasteur, Lille, France]

An outbreak of food poisoning in Lille, France, in Sept. 1969, involving 100 persons, was found to be due to commercial cakes containing pastry cream made by 1 particular producer. The causative organisms were coagulase-positive staphylococci, in counts ranging from 1 to 960 × 10^6/g. A total of 38 strains were isolated. Two separate disinfections of the factory were required before cakes produced there were free from the relevant organisms. A survey of other factories showed 20% also to be infected. Recommendations regarding hygienic measures in and inspection of such factories are discussed. HBr

88

[Pastry creams and public health. II. Content of pathogenic staphylococci in pastry creams in the Lille area.]
Catsaras, M.; Seynave, R.; Sery, C.
Annales de l'Institut Pasteur de Lille **22**, 245-261 (1971) [1 ref. Fr, en] [Centre d'Enseignement et de Recherches de Bact. Alimentaire, Inst. Pasteur, Lille, France]

During the period April-Nov. 1970, 359 samples of non-dairy pastry creams from 167 manufacturers (11 commercial and 156 small confectioners) were examined for pathogenic staphylococci. In samples from 119 (71%) of the manufacturers, no staphylococci were detected; the amount of contamination found with the other 48 manufacturers was: 1-10 staphylococci/g cream (16 manufacturers); 10-100/g (19); 100-1000/g (8); and >1000/g (5). In 3 subsequent tests, staphylococcal contamination was only detected with 12, 15 and 16 manufacturers of 43 which had produced positive results in the first trial. Analysis of the results of further studies of 63 samples from 9 of the manufacturers showed that the contamination often occurred during cooling of the cream. The need for adequate hygiene during manufacture and pre-sale handling of the pastry creams is discussed. MEG

89

Effect of water activity on heat survival of Staphylococcus aureus, Salmonella typhimurium and Salm. senftenberg.
Horner, K. J.; Anagnostopoulos, G. D.
Journal of Applied Bacteriology **38** (1) 9-17 (1975) [13 ref. En] [Dept. of Microbiol., Queen Elizabeth Coll., Campden Hill, London, W8, UK]

The viability of Staph. aureus heated at 55°C in phosphate buffer [pH 7.0] was determined on

recovery media of different water activity (a_w) levels. The basal recovery medium, tryptone-soya agar (a_w 0.997) was adjusted to lower a_w levels by addition of NaCl, glycerol or sucrose. Max. survival occurred at a_w 0.997; viability was reduced to 10% of the max. at a_w 0.98 when a_w was controlled by sucrose or NaCl but not until a_w 0.93 with glycerol. To eliminate effects such as incomplete mixing or post heating dilution and in order to use conditions comparable to those occurring in foods, a solid medium heating/recovery method was also used; this involved heating, by immersion, of surface-inoculated agar plates and recovery of survivors in situ. Staph. aureus, Salm. typhimurium and Salm. senftenberg 775W were heated at 55°C and recovered in situ on tryptone-soya agar adjusted to lower a_w levels as above. Max. survival of Staph. aureus occurred at a higher a_w with glycerol (a_w 0.965) than with NaCl (0.92) or sucrose (0.90). The max. survival of both Salm. typhimurium and Staph. aureus heated at 55°C occurred at the same a_w (0.965) with glycerol. This max. was not affected by the duration of heating. In contrast, heat resistance of Salm. senftenberg 775W was virtually unaffected by reduction in the a_w of the heating/recovery medium at the levels tested. AS

90

Repair, growth, and enterotoxigenesis of Staphylococcus aureus S-6 injured by freeze-drying.
Fung, D. Y. C.; Bosch, L. L. vanden
Journal of Milk and Food Technology **38** (4) 212-218 (1975) [28 ref. En] [Dept. of Microbiol., Pennsylvania St. Univ., University Park, Pennsylvania 16802, USA]

Staph. aureus S-6 cells in the mid-log growth phase rapidly (0.5-1 h) repaired freeze-drying injury when rehydrated at mesophilic temp. (20-50°C), although these temp. had a greater effect on subsequent growth of total survivors. At 15°C repair and growth processes were slow. At 10°C repair and growth did not occur. Enterotoxin B was released into the rehydration medium at about the time when survivors initiated growth but was difficult to demonstrate during the repair stage because of the short duration of this phase. Metabolic and macromolecular inhibitor studies on Staph. aureus S-6 cells injured by freeze-drying suggested that RNA synthesis was necessary as the first stage of repair. AS

91

An improved method for the detection of staphylococcal enterotoxins A & B. [Lecture]
Caserio, G.; Valcamonica, C.; Giolitti, G.; Pedretti, C.; Cicognani, G.; Cerrato, A.
II, 43-51, 53-64 (1974) [18 ref. En, It] [Istituto di Ispezione degli Alimenti di Origine Animale, Univ. di Milano, Milan, Italy]

The immunogel diffusion method for detecting enterotoxins A and B in food was improved by simplifying toxin extraction and microslide preparation methods. A widely applicable and sensitive method was developed using Brilliant Blue R as staining agent, detecting enterotoxins at concn. of 0.3 µg/ml. [See also author index under

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Clostridium perfringens inhibition by sodium nitrite as a function of pH, inoculum size and heat.
Riham W. E., Jr.; Solberg, M.
Journal of Food Science **40** (3) 439-442 (1975) [13 ref. En] [Dept. of Food Sci., Cook Coll., Rutgers Univ. - St. Univ. of New Jersey, New Brunswick, New Jersey 08903, USA]

The effect of heat, pH, inoculum size and nitrite concn. on the inhibition of various Cl. perfringens strains was characterized. The inhibition of 6 strains in filter sterilized medium was correlated to the amount of undissociated nitrous acid. The same was not true in autoclaved medium where a more potent inhibitor appeared to exist. A 4-log cycle increase in inoculum cell concn. increased nitrite tolerance 5- to 10-fold in filter sterilized medium and 10- to 100-fold in autoclaved medium. The relationship between log inoculum size and log nitrite concn. necessary for inhibition was linear for strain 8797. For every 6.8 min exposure of a nitrite-containing culture medium to heat at 121°C, the inhibitory concn. of nitrite for strain 8797 was diminished by 90%. IFT

93

Clostridium perfringens growth in a nitrite containing defined medium sterilized by heat or filtration.
Riha, W. E., Jr.; Solberg, M.
Journal of Food Science **40** (3) 443-445 (1975) [12 ref. En] [Dept. of Food Sci., Cook Coll., Rutgers Univ. - St. Univ. of New Jersey, New Brunswick, New Jersey 08903, USA]

The growth of Cl. perfringens 8797 in a nitrite-containing chemically defined medium at pH 6.3 was characterized with respect to the method of medium sterilization and nitrite concn. All cultures which grew in either autoclaved or filter sterilized medium demonstrated equivalent generation times and reached equivalent max. cell concn. regardless of the nitrite concn. A significant difference in adjustment phase duration existed between autoclaved and filter sterilized medium, although within each type of medium the duration of the adjustment phase was homogeneous regardless of the nitrite concn. The effect of nitrite appeared to be cellular and was permanent. IFT

94

[Factors favourable to Clostridium botulinum spore development in canned vegetables with mushrooms.]
Ovrutskaya, I. Ya.; Novitskaya, V. E.; Sargovets, T. A.; Skripnichenko, V. S.
Konservnaya i Ovoshchesushil'naya Promyshlennost' No. 10, 12-13 (1974) [Ru] [Vses. Nauchno-issled. Inst. po Proizvodstvu Produktov Pitaniya iz Kartofelya, USSR]

Factors enhancing Cl. botulinum spore growth and botulotoxin formation in canned products were

investigated using 'potatoes with mushrooms' and 'vegetable solyanka with mushrooms'. The pH of the investigated canned products was 3.9-4.5 (solyanka), and 4.3-4.5 (potatoes). These products were sterilized and experimentally inoculated with a suspension of Cl. botulinum spores, 10^6/g of product. After sealing the samples (50 g each) with sterile paraffin, the test tubes were allowed to remain at 20°C for 18 months. Survival of the spores, pH changes and botulotoxin formation were determined. The spores did not lose their viability even after 18 months, irrespective of the pH. The toxin was found after 6-7 days in samples of pH 4.3-4.8, and after 5 days in pH 5 samples, and was constant for another 9 months. Samples of pH 4.1-4.2 did not contain the toxin. The amount of the toxin in the sauerkraut solyanka was 10× higher than in the potatoes. Cl. botulinum spores and botulotoxin were found in all the raw materials. Thorough washing, higher addition of acetic acid to the boiled mushrooms and strict adherence to sterilization procedures are recommended. STI

95

[Survival and multiplication of coagulase-positive staphylococci during manufacture and short-term storage of tvorog under laboratory conditions.]

Trin'ko, S. E.; Koroleva, N. S.

Trudy, Vsesoyuznyi Nauchno-Issledovatel'skii Institut Molochnoi Promyshlennosti No. 35, 31-38, 105 (1974) [6 ref. Ru] [VNIMI, Moscow, USSR]

Tvorog was prepared in the laboratory by the acid/rennet method from milk contaminated before coagulation by addition of 100-100 000 Staphylococcus aureus/ml. A Streptococcus lactis/Str. acetoinicus starter or the 'Kaunas' starter in which Str. cremoris predominates was used. Counts of Staph. aureus increased during the initial stages of tvorog manufacture, largely as a result of concentration in the coagulum in the process of syneresis. During storage of finished tvorog, the count of Staph. aureus diminished gradually from an initial value of 480 000/ml, none being detected after 5 days at 6°C, 3 days at 18°C or 1 day at 26° or 37°C. As Staph. aureus content of finished tvorog depends largely on initial level of contamination, improvement of bacteriological quality of the manufacturing milk is of prime importance. SKK

96

[A study on the distribution of Clostridium welchii in fishes and shellfishes in Korea.]

Sohn, J. Y.; Rycom, K.; Kim, Y. H.; Lee, M. W.; On, O.; Ryu, J. K.

Report of the National Institute of Health **10**, 79-88 (1973) [27 ref. Ko, en] [Dept. Microbiol., Nat. Inst. Health, Seoul, Korea]

653 samples of fishes, shellfishes, squids and shrimps collected from Incheon, Masan and Busan coasts of Korea from May to Oct. 1973 were examined for the occurrence of Clostridium welchii. 242 isolates were identified as Cl. welchii type A, among which 17 strains were heat resistant. 42 isolates were identified as Cl. welchii Hobb's type. KoSFoST

97

Sporulation of Clostridium putrefaciens and the resistance of the spores to heat, γ-radiation and curing salts.

Roberts, T. A.; Derrick, C. M.

Journal of Applied Bacteriology **38** (1) 33-37 (1975) [9 ref. En] [Agric. Res. Council, Meat. Res. Inst., Langford, Bristol BS18 7DY, UK]

Studies on factors (medium, heat treatment, γ-irradiation, NaCl, pH, $NaNO_2$, incubation temp.) influencing sporulation and growth of Clostridium putrefaciens are described. Although C. putrefaciens grew well in most media commonly used for culture of anaerobes (trypticase/peptone/yeast extract/glucose/cysteine agar; blood agar; lactose/egg yolk medium; reinforced clostridial agar + bicarbonate; cooked meat medium) significant sporulation occurred only on lactose/egg yolk medium. C. putrefaciens was found to be of moderate resistance to heat and γ-irradiation. Growth of C. putrefaciens increased with increasing incubation temp. and pH over the range tested (≤25°C and ≤pH 7.5), and decreased with increasing NaCl and $NaNO_2$ concn. These observations are discussed, with special reference to the trend towards reduced NaCl and nitrite concn. and increased pH of cured hams. AJDW

98

A study on the characterization and molecular determinants for the psychrophily of psychrophilic clostridia isolated from Puget Sound.

Finne, G.

Dissertation Abstracts International, B **35** (8) 3968-3969: Order no. 75-3976 (1975) [En] [Washington Univ., Seattle, Washington 98105, USA]

Marine sediments were inoculated into cooked meat medium; the isolated organisms were separated according to their min. optimum and max. growth temp. into obligate and facultative psychrophilic and psychrotrophic clostridia. For their characterization, DNA was extracted and volatile alcohols and acids produced on glucose medium were determined: no relationship between DNA composition and growth temp. or metabolic products was found. A study of the temp. stability of triose phosphate isomerase in isolates and in cell-free extracts suggests that enzyme stability was not a controlling factor in psychrophilic behaviour. The membrane lipid viscosity as determined by electron paramagnetic resonance appeared to be the molecular determinant for the psychrophilic nature of the organisms, the lipids being in a fluid state at growth temp. The growth range of an organism is dependent on its ability to regulate its membrane lipid fluidity within a narrow temp. range. FSB

99

Effect of sodium nitrite and nitrate on Clostridium botulinum growth and toxin production in a summer style sausage.

Christiansen, L. N.; Tompkin, R. B.; Shaparis, A. B.; Johnston, R. W.; Kautter, D. A.

Journal of Food Science 40 (3) 488-490 (1975) [3 ref. En] [Swift & Co., Res. & Development Center, Oak Brook, Illinois 60521, USA]

2 experiments were conducted to determine the growth potential of Cl. botulinum in fermented sausage. The first test demonstrated that growth and toxin production did not occur during fermentation. Product stored at 27°C did not become toxic. This may be explained by acid production which occurred with sufficient rapidly to negate any nitrate or nitrite effect. The relative effects of nitrite, dextrose and starter culture on Cl. botulinum growth in thuringer stored at 27°C were then evaluated. Growth of Cl. botulinum was prevented in sausage formulated with dextrose and ≥50 μg nitrite/g meat. Average pH of these samples decreased from an initial 5.63 to 4.68 within 1 wk at 27°C. Omitting dextrose from the sausage formulation resulted in samples in which the pH remained at the initial level throughout storage. In these samples, increased nitrite levels ≤150 μg/g meat retarded but did not completely prevent toxin production. IVT

100

Biochemical activity of staphylococci isolated from raw meats.

Mayura, K.; Mandokhot, U. V.; Dwarakanath, C. T.

Journal of Food Science and Technology, India 11 (6) 274-277 (1974) [31 ref. En] [Central Food Tech. Res. Inst., Mysore, India]

Biochemical characteristics of staphylococci strains isolated from 45 sheep and goat carcasses on sale in a Mysore meat market were studied in order to evaluate the significance of raw meat as a reservoir of staphylococci of potential public health importance. Samples were enriched initially in mannitol salt broth for 24 h at 37°C and then streaked onto staphylococci medium No. 110. Pure isolates were tested for production of α-haemolysin, lipolysis, and gelatinase and coagulase activities. Results are tabulated. 18 out of 173 isolates were coagulase negative. From an association study of various biochemical characteristics with coagulase activity it was found that lipolytic activity and the combination of mannitol fermentation and lipolytic activity showed highest association with coagulase activity. It was concluded that sheep and goat meat were a potential reservoir for pathogenic staphylococci. CRI

101

Persistence of Staphylococcus. Bruised tissue microenvironment affecting persistence of Staphylococcus aureus.

Roskey, C. T.; Handy, M. K.

Journal of Food Science 40 (3) 496-499 (1975) [18 ref. En] [Dept. of Food Sci., Univ. of Georgia, Athens, Georgia 30602, USA]

Tissue extracts of pectoralis major muscle from contused chickens (8-10 wk old) were prepared and inoculated with Staph. aureus. Extracts of normal (non-bruised) chicken muscle were treated in a similar manner and served as controls. Bacterial growth, cell respiration and virulence factors were determined. Traumatized tissue extracts (TTE) supported active microbial growth but coagulase, β-haemolysin, hyaluronidase and enterotoxin B were inhibited, particularly during early stages of healing (1-4 days). These aforementioned factors increased after 6-8 days to reach the level noted in normal tissue extract. Increased respiration of bacterial cells was noted in TTE whereas haemoglobin (0.0035 μmoles/ml) inhibited both respiration and enterotoxin B formation. The accelerated growth of staphylococcal cells in bruised tissue creates a greater opportunity for selection of those viable cells that are resistant to natural tissue bactericidal substances and may therefore account for their prolonged persistence in bruised tissue. IVT

102

[Clostridium perfringens in a pipeline, and its implication in spoilage of sausages.] Clostridium perfringens in einer Rohrleitung - Ursache für ungeklärten Wurstverderb.

Ernst, H.

Fleisch 28 (11) 214-215 (1974) [11 ref. De] [Abteilung Lebensmittelhygiene, Vet.- und Tiergesundheitsamt, Leipzig, German Democratic Republic]

After a brief discussion of spoilage of meat products by Cl. perfringens, an outbreak of spoilage of boiled sausages (especially black puddings) by Cl. perfringens in a meat products factory in Leipzig, German Democratic Republic, is described. The source of contamination was found to be a steel pipeline carrying sausage emulsion; this pipeline had cracks at the junctions between lengths of pipe, in which sausage emulsion accumulated. Very high counts of Cl. perfringens were detected in residual sausage emulsion in these cracks. Installation of a new stainless steel pipeline (assembled with care to avoid spaces in which the sausage emulsion could accumulate) eliminated spoilage by Cl. perfringens. AJDW

103

[The heat resistance of Clostridium perfringens spores under various sterilization conditions.]
Nikolaeva, S. A.
Trudy, Vsesoyuznyi Nauchno-issledovatel'skii Institut Konservnoi i Ovoshchesushil'noi Promyshlennosti **21**, 44-49 (1974) [18 ref. Ru]

Cl. perfringens type A spores were isolated from canned gherkins (strain 141), root vegetables (strains 351 and 495), force-meat (strain 809), soil (strain 302) and 'cod in butter' (strain 225). Heat resistance of the spores was studied in 0.1% peptone liquor (pH 7.1) using the capillary method and in canned foods using the beaker method at 85°, 95° and 98°C. During heating, 3 phases were observed: (i) up to 85°C, when the number of spores does not change, (ii) when 99.9% of spores are killed, and (iii) when the remaining spores maintain their vitality for a long time before dying. The lethality of present commercial sterilization conditions was experimentally established. Results indicated that initial spore counts of $\leq 5 \times 10^3$/g in meat, 10^6/g in fish and ≤60/ml of liquid in vegetable products were eliminated by sterilization under commercial conditions. STI

104

Effect of pH and heat on type A spores and toxin of Clostridium botulinum.
Grecz, N.; Lin, C. A.; Suzuki, J. B.
Developments in Industrial Microbiology **15**, 387-396 (1974) [30 ref. En] [Dept. of Biol., Illinois Inst. of Tech., Chicago, Illinois 60616, USA]

Since a wide range of pH values is represented in processed foods, an investigation was performed to examine the effect of pH on toxicity and inactivation of botulinal toxin. In a series of incubations, spores and spore toxin of Cl. botulinum were suspended in borate buffer (pH 2-12). Time of exposure of these incubations to heat (23-90°C) was varied, and the resultant toxicity and spore viability were determined. Spores of Cl. botulinum became extremely sensitive to heat under acidic and alkaline conditions. The heat resistance of these spores was max. at pH approaching neutrality and was inversely proportional to deviations from pH 7.0. Heat resistance of spore toxin appeared to be more resistant to changes in pH than the heat resistance of molecules responsible for spore viability. This may have pertinent repercussions in currently available food processing methods. AS

105

Prevention of food poisoning.
Betz, N. L.
Cereal Science Today **19** (12) 531-532, 544-545 (1974) [En] [Ralston Purina Co., St. Louis, Missouri, USA]

Consideration is given to the causes of food poisoning, to factors affecting bacterial growth and to the prevention of bacterial food poisoning caused by Staphylococcus spp., Clostridium botulinum, Cl. perfringens, Salmonella spp. and Streptococcus spp. VJG

106

Heat-stable nuclease for assessment of staphylococcal growth and likely presence of enterotoxins in foods.
Tatini, S. R.; Soo, H. M.; Cords, B. R.; Bennett, R. W.
Journal of Food Science **40** (2) 352-356 (1975) [15 ref. En] [Dept. of Food Sci. & Nutr., Univ. of Minnesota, St. Paul, Minnesota 55108, USA]

Growth of Staphylococcus aureus and simultaneous production of heat-stable nuclease (DNAase) and enterotoxins were evaluated in experimentally inoculated foods (milk, skim-milk, cream, cheese whey, raw and cooked ground beef, bologna and smoked sausage), and in some commercially prepared foods. DNAase was detected whenever Staph. aureus reached 5×10^5-1×10^6/g or ml, whereas enterotoxins were detected at higher Staph. aureus population ($\geq 5 \times 10^6$/g). Commercial Cheddar cheese containing $\geq 1.5 \times 10^6$ Staph. aureus/g showed detectable DNAase and no enterotoxins. Samples of butter, dried malted milk, dried skim-milk, Genoa sausage and ham which had been involved in food poisoning showed presence of detectable levels of DNAase and enterotoxins. All commercial samples showing detectable enterotoxin also showed detectable amounts of DNAase. [Further work is suggested in order to establish whether or not heat-stable DNAase production is unique to Staph. aureus, and whether or not DNAase is always present along with enterotoxin in foods involved in staphylococcal food poisoning.] [See also FSTA (1974) **6** 4P566.] IFT

107

Growth of staphylococci in relation to normal microflora and enterotoxin production in milk.
Ghosh, S. S.; Laxminarayana, H.
Indian Journal of Animal Sciences **43** (11) 981-986 (1973) [15 ref. En] [Nat. Dairy Res. Inst., Karnal, Haryana, India]

Staphylococci were tested for their ability to grow and produce enterotoxin (A or B) at 35°C in raw milk with (i) high initial bacterial count (>10 million/ml) or (ii) average bacterial count (<5 million/ml), and in (iii) commercially pasteurized milk (1.5 million-3 million/ml). In all 3 types of milk, inocula of $<10^5$ Staph. aureus/ml were rapidly outgrown by the milk microflora, and no enterotoxin was detected by the time the milk curdled. The flora of (i) also outgrew Staph. aureus inocula of 8 million/ml, but in (ii), Staph. aureus inoculated at 9 million/ml were able to multiply and enterotoxin was detected after 3 h when the Staph. aureus count was 45 million/ml. In (iii), Staph. aureus inoculated at 5 million/ml multiplied to 50 million/ml at 12 h, and enterotoxin was then detected. When 3 human volunteers were fed milk containing detectable amounts of enterotoxin A or B, symptoms of gastroenteritis developed within 2.5-3 h and remained acute until medical treatment was introduced at 12 h; a 3rd volunteer who was fed milk in which a non-toxinogenic strain had been grown did not develop any symptoms. CDP

108

Correlation between the production of enterotoxins A and B and some biochemical characteristics of Staphylococcus aureus strains isolated from milk and dairy products. [Lecture]
Otenhajmer, I.; Mitic, S.; Stojanovic, L.
II, 227-231, 233-237 (1974) [En, It] [Dairy Inst. of Yugoslavia, Belgrade, Yugoslavia]

36 coagulase-positive staphylococcal strains isolated from milk and dairy products were examined for biochemical characteristics. Of the 36, 14 strains were enterotoxigenic, producing enterotoxins A and B in the ratio 2:1; all fermented mannitol; 94.4% produced phosphatase; 80.5% produced hyaluronidase; all produced haemolysin (22.2% each of β- and δ-, 2.8% α- and >50% a combination of the 3 types). No correlation was found between enterotoxin production and other biochemical characteristics used in routine examinations. The greatest difference was in haemolysin production, with toxigenic and non-toxigenic strains producing 7.1 and 0% α-, 28.6 and 18.2% β-, and 14.3 and 27.3% δ-haemolysin, respectively. [See also author index under **Italy**, Federazione delle Associazioni Scientifiche e Tecniche [Symposium].] RM

109

[Relationship between staphylococcal counts and accumulation of enterotoxin type A in milk.]
Petrushina, L. I.; Bugrova, V. I.; Nikolaeva, I. S.
Gigiena i Sanitariya No. 4, 113-115 (1975) [3 ref. Ru] [Inst. Pitaniya AMN SSSR, Moscow, USSR]

An account is given of various investigations into conditions favouring staphylococcal growth and enterotoxin production in milk. In one experiment, staphyloccal counts increased from 5000 to 10^8-10^9/ml within 10-12 h at 37°C and within 18 h at 27°C (pH 6.3); enterotoxin production was much slower at the latter temp. Other experimental results showed that enterotoxin production by low levels of staphylococci (5000/ml) was inhibited by an accompanying microflora in milk with high total bacterial counts (750 000 cells/ml). Rapid falls in pH (to about 4.5) also inhibited enterotoxin production. ADL

110

Infection of frozen flounders with Clostridium botulinum of Type E. [Lecture]
Mierzejewski, J.; Matras, J.
II, 183-194 (1974) [17 ref. En, It] [Res. Centre of Vet. Service, Pulawy, Poland]

Examination of 100 frozen flounders obtained from commercial sources revealed the presence of toxigenic strains of Cl. botulinum type E in 5 cultures from the intestine and 1 culture isolated from muscle tissue, equivalent to 10 and 2% infection rates in the frozen fish. Results suggest that deep freezing may contribute to an increase in infection. [See also author index under **Italy**, Federazione delle Associazioni Scientifiche e Tecniche [Symposium].] RM

111

[Staphylococcal poisoning due to contamination of meat during processing.]
Sinell, H. J.
Ellenike Kteniatrike **17** (4) 179-185 (1974) [22 ref. Gr, de]

112

Effect of pH and sodium chloride on growth of Bacillus cereus in laboratory media and certain foods.
Raevuori, M.; Genigeorgis, C.
Applied Microbiology **29** (1) 68-73 (1975) [24 ref. En] [Dept. of Food Hygiene, Coll. of Vet. Med., Helsinki 00550, Finland]

Effects of NaCl concn., pH, and water activity (a_w) on ability of vegetative cells of B. cereus to initiate aerobic growth in brain heart infusion broth at 30°C were studied in a factorial design experiment. By using multiple regression techniques, equations were derived which related decimal reduction of bacterial population to concn. of NaCl and pH of broth to which the population was exposed. From these equations, % of inoculated cells capable of initiating growth could be calculated. The reliability of these equations in foods was tested in laboratory-processed meat and rice media. Foods were less inhibitory than broths, so that accurate prediction of growth initiation in foods was not possible by using the developed formulas. The impact of this type of quantitative study on development of specific microbial standards for foods is discussed. When NaCl concn. is increased, a_w is decreased and, with increased deviation of pH from optimum, more conc. inoculum of B. cereus cells is needed to assure initiation of growth in culture media and foods. AS

113

The effect of the antibiotic, Everninomicin, on control of Clostridium botulinum in foods.
Insalata, N. F.; Haas, G. J.
Journal of Milk and Food Technology **38** (6) 343-346 (1975) [43 ref. En] [General Foods Corp., Tech. Center, 250 North Street, White Plains, New York 10625, USA]

Everninomicin was evaluated for its effect on Cl. botulinum. Enrichment broth tests with Cl. botulinum Type A demonstrated the effectiveness of 1 ppm Everninomicin in inhibiting exotoxin formation in sporulation broth. Tests using Everninomicin in selected foods demonstrated: Type A exotoxin formation was inhibited by 10 ppm Everninomicin D in inoculated corn; formation of Type E exotoxin was inhibited by Everninomicin D at 1 ppm in inoculated fish; Type A exotoxin formation was not inhibited in sausage by 1 ppm or 10 ppm Everninomicin D. However, when used in ground beef, Type A exotoxin formation was inhibited by 8.0 ppm of Everninomicin B. AS

114

[The development of microorganisms causing botulism in preserved tomato products.]
Rozanova, L. I.
Trudy, Vsesoyuznyi Nauchno-issledovatel'skii Institut Konservnoi i Ovoshchesushil'noi Promyshlennosti **21**, 54-57 (1974) [5 ref. Ru]

The development of microorganisms causing botulism was studied in commercially produced tomato juice and in pumpkins in tomato sauce. Sterile products were inoculated with clostridium botulinum spores. The nutritional content of the product was supplemented by an addition of 0.5% glucose and 0.5% yeast hydrolysate, the pH was established using potentiometry, and the samples were incubated at 37°C. The biological activity of the toxin was established by tests using white mice. It was found that with a population of 5.10^4 Cl. botulinum spores ml, botulism precursors developed in pumpkins at all pH values investigated (4.45-4.75) and the toxins were formed within 8 days or less. In the case of tomato juice the microorganisms developed and toxins were formed at pH 4.7, with a minimal number of spores of 1450/ml; when the spore count was lower botulism was not observed, even after 13 months. The addition of enrichers did not affect the development of botulism. STI

115

Correlation between the production of enterotoxins A and B and some biochemical characteristics of Staphylococcus aureus strains isolated from milk and dairy products.
Otenhajmer, I.; Mitic, S.; Stojanovic, L.
Acta Veterinaria, Yugoslavia **24** (6) 255-259 (1974) [22 ref. En, sh] [Inst. za Mlekarstvo, Belgrade, Yugoslavia]

25 coagulase-positive Staph. aureus strains from milk, 5 from dried milk, 5 from processed cheese and 1 from Trapist cheese were studied; 9 strains produced enterotoxin A and 5 enterotoxin B. No correlation was found between enterotoxin production and any of the biochemical characteristics studied (mannitol, phosphatase, hyaluronidase or haemolysin production, egg yolk reaction or pigment formation). CDP

116

Food. Is it safe? [Conference proceedings]
Medlock, J. M. (**United Kingdom**, Association for the Study of Infectious Disease)
Postgraduate Medical Journal **50** (588) 597-647 (1974) [many ref. En]

Papers presented at a Symposium held at the Zoological Society's Large Meeting Room, Regent's Park, London NW1, on 16 Nov., 1973, include: Clostridium welchii and Bacillus cereus infection and intoxication, by B. C. Hobbs (pp. 597-602, 51 ref.); and Staphylococcal food poisoning and botulism, by R. J. Gilbert (pp. 603-611, 78 ref.). A further 5 papers are abstracted separately and indexed additionally under **UK**, Association for the Study of Infections Disease [Symposium]. VJG

117

Influence of water activity on growth and enterotoxin formation by Staphylococcus aureus in foods.
Troller, J. A.; Stinson, J. V.
Journal of Food Science **40** (4) 802-804 (1975) [11 ref. En] [Procter and Gamble Co., Winton Hill Tech. Center, Cincinnati, Ohio 45224, USA]

Previously published data pertaining to inhibition of staphylococci enterotoxin production in low water activity (a_w) laboratory media have been confirmed in 2 experimental food systems (shrimp slurries, potato doughs). Enterotoxin A production by Staph. aureus 196E was prevented at a_w 0.93 and enterotoxin B production by Staph. aureus S-6 was prevented at a_w 0.91 in shrimp slurries. Growth rates, maximal total numbers and toxin levels relative to cell yield were also suppressed as a function of a_w level. Similar results were obtained in potato doughs adjusted to various a_w levels. [See also FSTA (1971) **3** 9C153.] IFT

118

The influence of spaghetti extruding, drying and storage on survival of Staphylococcus aureus.
Walsh, D. E.; Funke, B. R.
Journal of Food Science **40** (4) 714-716 (1975) [17 ref. En] [Dept. of Cereal Chem. & Tech., N. Dakota St. Univ., Fargo, N. Dakota 58102, USA]

Dough was inoculated with Staph. aureus and processed into spaghetti. The average population of Staph. aureus ATCC No. 12600 in the dough was 1.6×10^7 cells/g. Extrusion reduced the population to 7.2×10^6 cells/g. However, extrusion temp. and auger speed within the practical ranges for spaghetti processing did not significantly (5% confidence level) influence Staph. aureus population level. Drying of spaghetti in the usual 35°C range resulted in a 7-fold increase in the population of Staph. aureus. Ambient storage, on the other hand, resulted in a decrease of Staph. aureus population in dry spaghetti. For spaghetti with 4.9×10^7 and 1.5×10^7 cells/g of Staph. aureus strain 12600 and S-6 respectively, no enterotoxin development was detected. IFT

119

[Microbial toxins in cheese.]
Tybeck, E.
Karjantuote **57** (5) 6-8 (1974) [19 ref. Fi] [Valion Lab., Helsinki, Finland]

This review deals mainly with enterotoxins of staphylococci, causing food poisoning, and aflatoxins formed by moulds (particularly Aspergillus flavus). [From En summ., published separately.] ADL

120

Death of Staphylococcus aureus in liquid whole egg near pH 8.
Ng, H.; Garibaldi, J. A.
Applied Microbiology **29** (6) 782-786 (1975) [20 ref. En] [W. Regional Res. Lab., USDA, Berkeley, California 94710, USA]

Incubating and shaking Staphylococcus aureus in liquid whole egg causes a decline in viability.

During the period of agitation, the natural pH of the egg rises from about 7.2 to between 8.0 and 8.2 as a result of a loss of CO_2. However, if the pH of the egg is prevented from rising, either by not shaking or by addition of a buffer, S. Aureus will grow. The cause of death is traced to the presence of lysozyme of egg white. Interestingly, the action of lysozyme is not attributable to its bacterial lytic property but, instead, to the basicity of the lysozyme molecule. This conclusion is supported by the fact that the lytic property of lysozyme is known to have its optimal activity near neutrality and by the finding that protamine sulfate, a nonenzymatic basic polypeptide, also caused death of S. aureus at pH 8.0 but not at 7.0. It was postulated that the rise in pH renders the bacterial cells more negatively charged, so that in the presence of positively charged molecules like lysozyme or protamine sulfate a complex is formed, agglutinating the cells. AS

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7	Synthetic Dairy Products	□ £6.00	□ £2.00	□ £4.00
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9	Agglomeration of Powders	□ £6.00	□ £2.00	□ £4.00
10	Aseptic Packaging	□ £6.00	□ £2.00	□ £4.00
11	EEC Regulations	□ £6.00	□ £2.00	□ £4.50
12	Toxicology of Food Additives	□ £6.00	□ £2.00	□ £4.50
13	Deep Fat Frying	□ £9.00	□ £2.50	□ £6.00
14	Viscosity of Foods	□ £8.50	□ £2.00	□ £5.00
15	Taste Panels in Food Science	□ £6.00	□ £2.00	□ £4.50
16	Taints in Foods	□ £6.00	□ £2.00	□ £4.50
17	Microbial Toxins in Foods	□ £6.00	□ £2.00	□ £5.00
18	Smoked Food Products	□ £6.50	□ £2.00	□ £4.50
19	Disposal of Waste Food Products	□ £10.00	□ £2.00	□ £5.50
20	Use of Glucose in Food Products	□ £6.00	□ £2.00	□ £4.00
21	Emulsifiers in Foods	□ £7.00	□ £2.00	□ £4.50
22	Stabilizers in Foods	□ £7.50	□ £2.00	□ £4.50
23	Staling and Antistaling Additives	□ £6.00	□ £2.00	□ £4.00
24	Catering Industry	□ £6.00	□ £2.00	□ £4.50
25	Antioxidants	□ £7.50	□ £2.00	□ £5.00
26	Nitrosamines	□ £6.00	□ £2.00	□ £4.00
27	Content and Analysis of Mercury in Foods	□ £4.00	□ £2.00	□ £4.50
28	Content and Analysis of Lead in Foods	□ £4.50	□ £2.00	□ £4.50
29	Heatable Packs	□ £4.00	□ £2.00	□ £4.00
30	Sulphur Dioxide in Food Products	□ £5.50	□ £2.00	□ £4.50
31	Lactic Acid Bacteria in Beverages and Food	□ £8.50	□ £2.00	□ £5.00
32	Colorants	□ £6.50	□ £2.00	□ £5.00
33	Browning of Foods	□ £5.50	□ £2.00	□ £4.50
34	Aflatoxins	□ £4.50	□ £2.00	□ £5.00
35	Antibiotic Properties and Residues in Food excluding Nisin	□ £5.50	□ £2.00	□ £4.50
36	Nisin	□ £4.00	□ £2.00	□ £4.00
37	Cadmium in Foods	□ £4.00	□ £2.00	□ £4.00
38	Coffee	□ £8.00	□ £2.00	□ £5.50
39	Sorbic Acid	□ £5.00	□ £2.00	□ £4.00
40	Arsenic in Foods	□ £4.00	□ £2.00	□ £4.00
41	Ascorbic Acid	□ £3.50	□ £2.00	□ £5.50
42	Thickeners and Gelling Agents	□ £3.00	□ £2.00	□ £4.00
43	Pseudomonadaceae and Food Processing	□ £3.50	□ £2.00	□ £4.00
44	Spores in Food	□ £2.00	□ £2.00	□ £4.00
45	Breadmaking	□ £6.50	□ £2.00	□ £4.00
46	Bread Properties	□ £5.50	□ £2.00	□ £4.00
47	Food Science and Technology Books	□ £8.50	□ £2.00	□ £8.00
48	Nitrates and Nitrites in Meat Products	□ £3.00	□ £2.00	□ £4.00
49	Eggs & Poultry Meat		□ £5.00	□ £7.50
50	Mycotoxins in Foods (Excluding Aflatoxins & Microbial Toxins)	□ £2.00	□ £2.00	□ £4.00

Prices include postage by surface mail. For airmail rates, please apply to the address below.

To order, or obtain further information, mark the item required, add your name and address and send cash, cheque or postal order to:–

International Food Information Service (IFIS),
Commonwealth Bureau of Dairy Science and Technology,
Shinfield, Reading, RG2 9AT.,
England.

NAME .....

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